Western Progress and Superpower Issue

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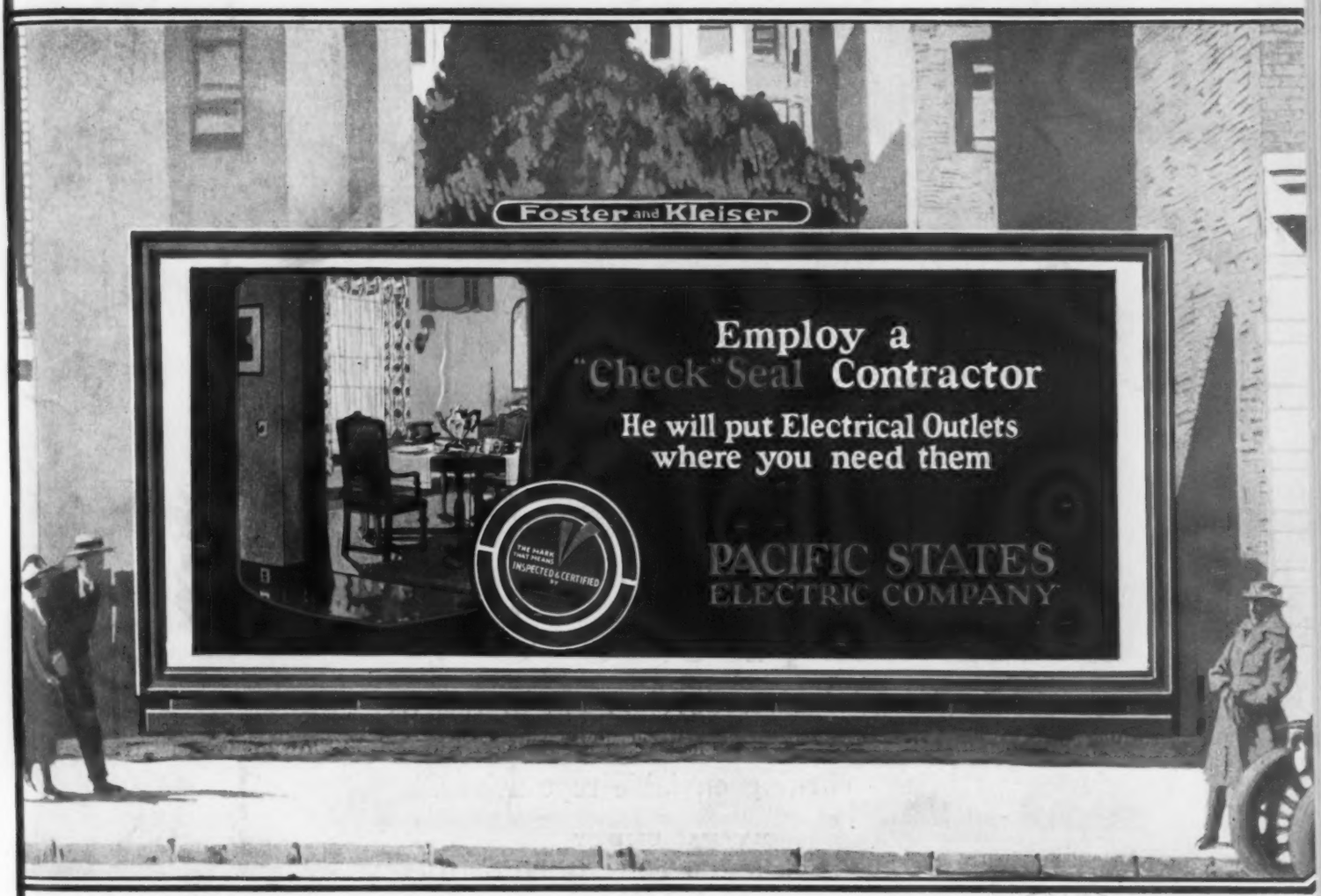
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A Word About Our New Map

IN this issue, as an insert, there is a map that is worthy of more than passing interest. It is a "brass tacks" kind of map, that tells at a glance the story of the conditions under which goods must be sold in the eleven Western states.

Consider, Mr. Sales Manager, that these eleven Western states represent 40 per cent of the area of the United States and less than 9 per cent of the population, and contemplate, for a moment, the effect that such conditions have put upon your Western selling costs. To emphasize this further, note the distances and cost of travel between population centers.

Reaching such a market is more of a task than might be imagined from a casual glance at a map hung on an office wall in New York, Chicago or St. Louis. There are some facts about it that this latest map compiled and published by the Journal of Electricity tries to tell. But in addition to its size, this market offers potential sales possibilities that cannot be overlooked.

Consider also, Mr. Sales Manager, that in these selfsame eleven Western states is found a greater development of the electrical idea than in any other portion of the United States, the total number of wired homes being 1,700,193. Then you may draw this conclusion: Advertising, that seeks out the interested prospect, that reaches the established channels of distribution, that directs them toward you and your product, is most emphatically the greatest single element known in reducing selling costs. The Journal of Electricity is the medium through which you can obtain such service.

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The Electrical West

WESTERNERS are seldom accused of an excess of modesty in speaking of their section of the country. True enough, the West is a country of superlatives, and even the canny New Yorker is shaken out of his proverbial conservatism when he views for the first time the grandeur of our mountains, and the fertility of our soil.

NEVERTHELESS, it is well for the good of our souls, to abandon generalities and get down to figures, cold hard figures, through which the actual facts, stripped of the perfervid oratory of the real estate booster, may be disclosed.

LET us then review these self-same cold hard facts, as they apply to the electrical industry of the West today, and from them extend the curve into the future. Let us not fool anybody, least of all ourselves, as to what we have, and what we may reasonably expect it to grow into.

WHAT makes a market for things electrical? First, a sufficiency of power, and second, customers who will use it. Scrutinizing carefully the statistical material gathered from many sources and presented in this issue, we learn some interesting things. The census of 1920 showed a growth in new population for the Western states of 4.5 per cent per year since 1910. Even discounting figures presented from unofficial sources showing a present rate of growth much greater than that, it is obvious that the 400,000 new people taking up their residence in the West each year must have homes, and with them electrical apparatus and appliances.

TO provide for these new people, and for those millions already here, electric generating capacity is increasing at the rate of 10 per cent per year, residential consumers are increasing at the rate of 11.5 per cent per year and kilowatt-hour output at the rate of 16 per cent per year.

UNDER such conditions, it is not surprising that the Western states present at once the widest use of electrical appliances in the country, the greatest number of wired homes per capita, and at the same time, the greatest over-all development and application of electrical energy.

THE electrical West is pointing the way to the rest of the world.

Development of Electric Truck Business in 1923

THE electric truck, an appliance which probably uses more energy than any other electric device yet invented, is demonstrating to central stations in California that here is a new business field worthy of development. Overlooked for many years by the electrical industry here in the West, it was forced to go its way alone. Through the efforts of the truck men, a few fleets were sold but little or no recognition of the importance of this market was forthcoming from the central stations.

At the instigation of the Electric Truck and Car Bureau of the Commercial National Section of the National Electric Light Association, a study of the possibilities in this field was conducted in California early in the year. Plans were made for the formation of an Electric Truck Bureau of the Pacific Coast Electrical Association and during the annual convention of that body in June, a definite program for an intensive sales campaign was announced.

The results have been most gratifying, considering the resistance which the Bureau found in its path. Since the inception of the campaign 67 electric vehicles were sold in the Los Angeles metropolitan area and 39 were sold on the lines of the Pacific Gas and Electric Company. Reports indicate that the prospective business in sight is more than sufficient to justify the continuance of the campaign into 1924.

The strides which have been made by the men in charge of this work are indicative of the fact that the possible applications of electricity to industry are many. An idea of the field to be served, a carefully planned campaign for reaching it and a sales staff imbued with confidence are the prime necessities.

Resumé of 1923 Commercial Department Sales Activities

DEVELOPMENT of domestic cooking, water heating and air heating load has been one of the outstanding features of the central station commercial activity in the eleven Western states during 1923. Electric range sales have demonstrated that the public is ready to accept this appliance. Properly directed educational effort has overcome much of the initial sales resistance in many districts and power companies who have directed their sales staffs toward this field have, in many cases, exceeded their fondest expectations.

A careful analysis of sales during the past year indicates that 18,000 electric ranges were installed, representing an increase of approximately 50 per cent in the number of ranges connected. In one locality in the Pacific Northwest there is one range for every five residential lighting consumers while one California company reports one range for every seven.

So important has this phase of central station activity become that a comprehensive analysis of the electric range business will be made in the Pacific Northwest during the coming year where it is estimated that one-sixth of the total number of ranges in the country are now installed. The survey will be made by an equal number of commercial men and engineers and every factor influencing this type of business will be studied.

The close of 1923 saw commercial department activity branch out into new fields, which promise to equal the domestic market in new business potentialities. Show window and store lighting prospects were cultivated with excellent results. Current-consuming domestic appliances received special attention and heavy duty restaurant and hotel equipment has been installed in many of the large cities as the result of cooperative sales drives in which central station and manufacturers have participated.

A review of the plans for 1924 as outlined by the major central stations indicates that increased sales effort will be applied to electric ranges and water heaters. Air heating promises to develop into an important field for new load. Already programs are being mapped out for intensive window and store lighting campaigns. Domestic appliances of all classes will be featured, in many localities a single appliance having been selected for special sales attention during a two or three-week period. Kitchen lighting units will be made the subjects for special drives during the spring months.

While 1923 might be characterized as having established a record in central station commercial department history, there is reason to believe that 1924 will eclipse it in every way for power company, manufacturer, jobber and dealer.

Public Ownership Might Be Likened to Prohibition

REGARDLESS of individual opinions on the subject of the eighteenth amendment and the Volstead Act, the history of the growth of the prohibition movement and the ultimate triumph of its organized protagonists are of more than passing interest.

It will be remembered that, at first, there were many attempts to force national prohibition upon the people. There was a Prohibition party that nominated candidates for president, as well as for the lesser national and state offices.

Failing to achieve their objective by these tactics, the organized "preventers" tackled the problem through individual state campaigns. A little headway was made, but it was not enough. Then came counties, cities, and the so-called "local option" idea, and then dry spots began to appear upon the thirsty map.

The dry rash spread, at first imperceptibly, and then gathering momentum, the wet areas began to appear as spots, diminishing little by little, until, lo and behold, the politicians began to take notice, and the justly celebrated eighteenth amendment was born, almost overnight, before the patrons of liquid joy knew what had happened to them.

History is said to repeat itself, therefore it behooves those who advocate the continuation of the development of our power resources through private

initiative under commission regulation to stop, look, and listen.

In this issue is a tabulation of power projects contemplated and under way in 1924. In all, there are 40 projects, aggregating 695,050 kw. Of these, no less than eight are municipal or other forms of government-owned enterprises, aggregating 219,000 kw. In other words, 20 per cent of the total number, and 32 per cent of the total horsepower represents a definite step in the socialization of our power development.

There is a lack of interest, a laissez faire attitude on the part of some of the power companies, that may ultimately work to their undoing. They are indifferent to the attacks of the government or state-ownership propagandists unless their individual enterprises are directly threatened. The time may come when they will realize, too late, that they should have defended private ownership wherever it was assailed, in New York, San Francisco or anywhere else. We may learn much from history, if we will only study it and apply its lessons to the solution of the problems of the future.

Application of Electricity to Industry Is Increasing

INDUSTRIAL activity in the West during 1923 was marked by the remarkable increase in the number of electrical applications. Hand in hand with development in the mining, oil and lumber industries has gone the increased utilization of electric power for performing work formerly done by steam or gas engines. Nor have electric applications been confined solely to those industries in which its use has hitherto been common. Central stations and manufacturers have cooperated in developing uses that are both new and unique.

During the past year the application of electricity to the lumber industry has been noteworthy. A number of completely electrified sawmills have been constructed and other mills have changed over from steam to electric drive. Several notable electric logging installations have been made and this field of application is rapidly increasing owing to the greater economy, flexibility and reduced fire hazard which electricity affords.

Resumption of mining activities in most of the districts, especially in the copper regions, brought forth calls for power to supply loads ranging from three to five hundred horsepower. The most notable mining installation was that of the New Cordelia Copper Company at Ajo, Ariz., where a newly completed mill has a load of approximately 10,000 hp. Two electric shovels were placed in operation in the surface mines of the Utah Copper Company at Bingham, Utah.

In southern California electric power was used more extensively than ever before for both drilling and pumping in the oil fields.

The year saw the completion of four electrically driven ferry boats and one oil tanker in California. Economy, flexibility, safety, greater speed and simplicity of control have proved to be the influencing factors in the application of electricity to ship drive. Several electrically operated dredges have been placed in operation in the Pacific Northwest.

The cement industry has been most active, with additional installations in many of the existing plants. Several new mills are contemplated, one of the most notable to be built on the shores of San Francisco Bay. This mill will be completely electrified.

The industrial heating field has furnished a number of interesting applications. An important advance has been made in California where electric heat has been successfully applied to the dehydration of walnuts in two instances. This opens up a wide field for the dehydration of fruits and it is expected that many applications will result from the studies which are being made at the present time. Electric incubation has attracted considerable attention. One installation at Petaluma, Calif., will have a capacity of 635,000 eggs and a power load of 630 kw. Another such installation is being made in Oregon. Such has been the progress in the industrial heating field during the year that almost all central stations are planning aggressive campaigns for this type of business during 1924.

Consideration of the progress in the industrial field during the past year tends to emphasize the statements that have been made that electric power will be the motive force of industry on the Pacific Coast. With a dearth of good coal and with an oil supply that is diminishing rapidly, all industry will ultimately be forced to turn to electric power. The hydroelectric resources of the region are so extensive and the development programs of the power companies so broad that a cheap and dependable supply of energy will always be available.

The Part of the Utility in Community Advertising

THE Washington Water Power Company is issuing an attractive folder, in time-table size, showing on one side a colored map of the territory served by its transmission lines, as well as the general character of the present industrial development, with railroad lines, the more important towns, and the principal drainage systems. On the opposite side there is printed matter describing, in a general way, with numerous photographs, the industries served by the company. This folder will be distributed by the transcontinental railroads which enter Spokane, in connection with the large program for advertising the Pacific Northwest. This booklet is a splendid example of the manner in which a public spirited company can advertise the whole community. No one who reads it can fail to be impressed with the wealth of the natural resources in the region surrounding Spokane, and particularly with the substantial character of a public utility which has, for a generation, aided in the development of that region. The Washington Water Power Company deserves to be congratulated on this effective plan of advertising.

CURRENT COMMENT

Some Facts About Service in Los Angeles

In their arguments for municipal ownership of all classes of utilities, both press and politicians are wont to point with pride to the results achieved by the Los Angeles Bureau of Power and Light. Comparisons are made between rates and service in this city and those places where private ownership and public regulation are the watchword. Invariably the comparisons are favorable to public ownership. It may be that only such figures as would tend to create a favorable impression are made public. An interesting sidelight on the Los Angeles situation is given in the current issue of "Edison Partners," the quarterly stockholders' bulletin of the Southern California Edison Company. The company vouches for the authenticity of the information offered. Under the heading, "Los Angeles Service," the bulletin says:

The Bureau of Power and Light of Los Angeles took control of the Edison Company's Los Angeles distributing system on May 1, 1917 (about five years prior to the actual payment of the money and transfer of title to the city). During this five-year period the business was conducted under an Operating Agreement, by the terms of which the Edison Company was required to turn over to the Bureau of Power and Light all of the collections from Los Angeles consumers served by the Edison distributing system after deducting only bare operating expenses and taxes, together with interest at the rate of 8 per cent a year on the agreed price for the property which the city had the option to buy.

In October, 1920, an ordinance, No. 40890 N.S., passed by the city council upon recommendation of the Power Bureau and Public Service Commission, increased rates to all consumers in Los Angeles served by both the city's own system and the Edison system then being operated for the benefit of the city. No increase was made in the 8 per cent annual interest paid to the company for the use of its system and, therefore, all of the rate increase went to the Bureau of Power and Light. This increase in rates gave the Bureau of Power and Light additional revenue from Los Angeles consumers of $800,000 a year.

On taking over the Edison distributing system, State taxes amounting to $412,500 a year which the company had been required to pay were eliminated, since the operating property of the Bureau of Power and Light is not taxable. This gave the Power Bureau an additional net revenue of $412,500.

The Power Bureau thus had an added revenue of $800,000 from increased rates and $412,500 by escaping the payment of taxes, and from this total of $1,212,500 a rate deduction of $600,000 was made, leaving the public $612,500 worse off.

By recent order of the Railroad Commission rates of the Southern California Edison Company have been reduced below the pre-war basis, but rates of the Bureau of Power and Light are still higher than before the war.

The lighting rate charged by the private companies in Los Angeles before the Bureau of Power and Light started operating was 5½ cents a kilowatt-hour and out of this the company paid taxes. The municipal plant began operation in a small section of the city with a lighting rate of 5 cents per kilowatt-hour which shortly thereafter was increased 12 per cent and the present municipal rate is 5.6 cents per kilowatt-hour, without the payment of any taxes. Private companies are now charged over 10 per cent of their total revenues for State and Federal taxes and municipal plants are charged nothing.

If the Bureau of Power and Light had to pay taxes, its present rate would be 6¼ cents per kilowatt-hour as compared with the private companies' rate of 5½ cents per kilowatt-hour which was in effect before the municipal plant started operation. For the last year's business reported consumers' rates of the Bureau of Power and Light were $862,500 more than pre-war rates, and taxes which private companies would have to pay on the same amount of business would amount to $776,260; in other words, to get back to pre-war rates and to give the consumers the benefit of the savings in taxes, present rates of the Bureau of Power and Light would have to be reduced $1,638,760.

Under its contract, the Edison Company supplies to the city all of the electricity needed which cannot be generated by the municipal plants on the aqueduct. The rate for this service varies with the amount used. The rate for November was .7726 cents per kilowatt-hour. The average for the last twelve months was .8759 cents per kilowatt-hour, which is 22 per cent less than the average rate for the previous twelve months (1.0674c.). The lower average rate for the past twelve months made a reduction in the total bill for the period of $304,820. A further reduction of 7½ per cent ordered by the Railroad Commission was just made effective on November 15, 1923.

During the past twelve months the Edison Company furnished the municipal system with 80 per cent more electricity and charged only 47 per cent more money for it than in the previous twelve months.

The Edison Company is in a position to supply all the power needed by the city to supplement its own supply—indefinitely.

Hetch Hetchy Water and Power Argument

The disposal of the byproduct power to be generated in connection with San Francisco's Hetch Hetchy project continues to furnish more than its share of news and comment for the press of that city and also the state. From the start the agitation for municipal distribution has been largely engineered by a certain group of newspapers. The past two weeks have witnessed a change in the attitude on the part of the Board of Supervisors and a tendency on their part to proceed with caution. Exemplary of the more sane tactics that have developed is an editorial in the San Francisco Chronicle under the heading, "After All, It's Water We Want." Excerpts from the editorial follow:

The question which most deeply interests intelligent business men and taxpayers is: What good will come from wasting money in securing a valuation of the electric distributing systems of the two public utility corporations mentioned?

It is admitted at the City Hall that if the city goes into the electricity business it will have to pay twice as much for its own "juice" as it is paying to the private corporation which is now supplying it.

The valuation scheme has been the big fight of those more or less crankily inclined. They admit that it will take more than a year for the Railroad Commission to arrive at a valuation of the existing plants. It will require an enormous amount of money and when it is completed all the city will have to show for the outlay will be a lot of figures on a lot of pieces of paper. Cannot the average business man and the taxpayer see that the whole thing is a huge joke?

The completion of the valuation will not give the city a distributing plant for its electric current. If the corporations refuse to sell at the figures placed on their property, condemnation proceedings would have to follow in the courts. This sort of litigation is long and costly. It might require four or five years to reach a decision.

But the city, in the first place, cannot even offer to buy these plants, or either of them, unless it has the money to pay for them. It cannot get the money unless the voters approve a bond issue.

Summing it all up and simmering it all down we find—just an awful lot of talk.

But do we hear these same men saying much, if anything, about a water supply for the city of San Francisco?

It is a water supply we want. It is a water supply we have been after for a long time—and we have got nothing, not even the much-talked-of electric current.

Is there any reason to believe that if more money is placed at the disposal of these officials there would not be a continuation of the outrageous waste in building a water supply for San Francisco?

Skagit River Development Under Fire

The part which Seattle is playing in the attempt to foist a Water and Power Act upon the people of Washington is receiving considerable attention from the press of that state. One of the chief arguments against the measure is the demand that Seattle prove its own success before urging the state to undertake such a highly technical and intricate business as the ownership and operation of hydroelectric utilities. Under the heading, "Let's Play Safety First," the Washington State Weekly says on this question:

Why should the state engage in a risky, burdensome and untried enterprise at this time? Why not wait and let Seattle prove the case for or against municipal ownership?

Seattle owns and operates a light and power utility and also owns and operates its own street railway system of transportation. It still remains to be proved whether or not municipal ownership of such utilities can be carried on successfully.

If it can't be done by Seattle it is surely too risky for the state to undertake. If it can be done, after it is proved is surely a better time for the state to undertake such an enterprise than before.

Why not wait for the proof?

Certain persons, hungry for something to do politically, will object to this, but what GOOD reason can they advance for such postponement? Why should anyone object to a safety-first policy? Why NOT let Seattle show what can be done with its Cedar River dam, its street railway properties and its Skagit development before committing the state to an adventure like that called for in the Erickson initiative?

Seattle is already involved in a $30,000,000 adventure which promises to demand $100,000,000 before it is through.

Why not try out the untried here before going into an adventure four times as large on a state-wide scale?

What do the editors of the state think of this suggestion?

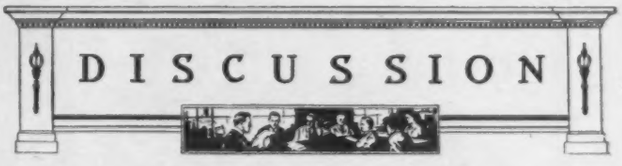
At the request of the Journal of Electricity, C. F. Uhden, chief engineer of the Skagit project of the City of Seattle, has prepared a statement outlining the status of that project and answering some of the objections raised by the press. Mr. Uhden says:

The cost of the first unit of the Skagit plant will be very close to the estimate made by the engineering department in 1920, the difference between the actual cost and the estimate being so small that it is practically negligible. In fact, the actual cost is going to be nearer the estimate than that of any plant which has been built on the Pacific Coast in the past 8 or 9 years. For this reason the City of Seattle should not be criticized in any way but should be given credit for its efficiency.

In addition to the 53,000 hp. we also have a 3,000-hp. plant installed on what we call Newhalem Creek, which is within about ½ mile of the Gorge Plant. Adding this 3,000 hp. to the 53,000 hp. at the Gorge Plant gives us 56,000 hp. which at a total cost, including transmission line and receiving substation, of $10,600,000, gives us a cost of approximately $190 per hp. This is an exceptionally low cost per horsepower when we take into consideration the fact that we have constructed in connection with this first development a railroad 26 miles in length which will serve for the entire development; have purchased a right-of-way 300 ft. in width which is sufficiently wide to take care of the power from the entire development. One transmission line, which is now being constructed and will be completed Mar. 1, 1924, has a capacity of 112,500 hp. The tunnel, which is 20 ft. 6 in. in diameter and 10,974 ft. in length, as well as the power house, are of sufficient capacity to take care of 112,500 hp. Our generators, which furnish us 53,000 hp. under the low temporary head, will furnish 50 per cent more energy when the head is finally raised with the permanent concrete dam.

In other words, we have a plant, which with an additional expenditure of four and one-half million dollars, will give us 115,500 hp. or an average cost, including transmission line and receiving substation, of approximately $130 per hp., which is as low a cost as has been obtained in any power plant which has been built in the Pacific Coast district during the past 10 years.

The Skagit River Development when completed will furnish 550,000 hp. at a cost not to exceed $100 per hp. This low cost is mainly due to the fact that we are fortunate enough to have an exceptionally large reservoir site which gives us a storage of 1,300,000 acre-ft., the largest artificial reservoir in the United States.



Error in Computation of Load on Conductors Found in Construction Article

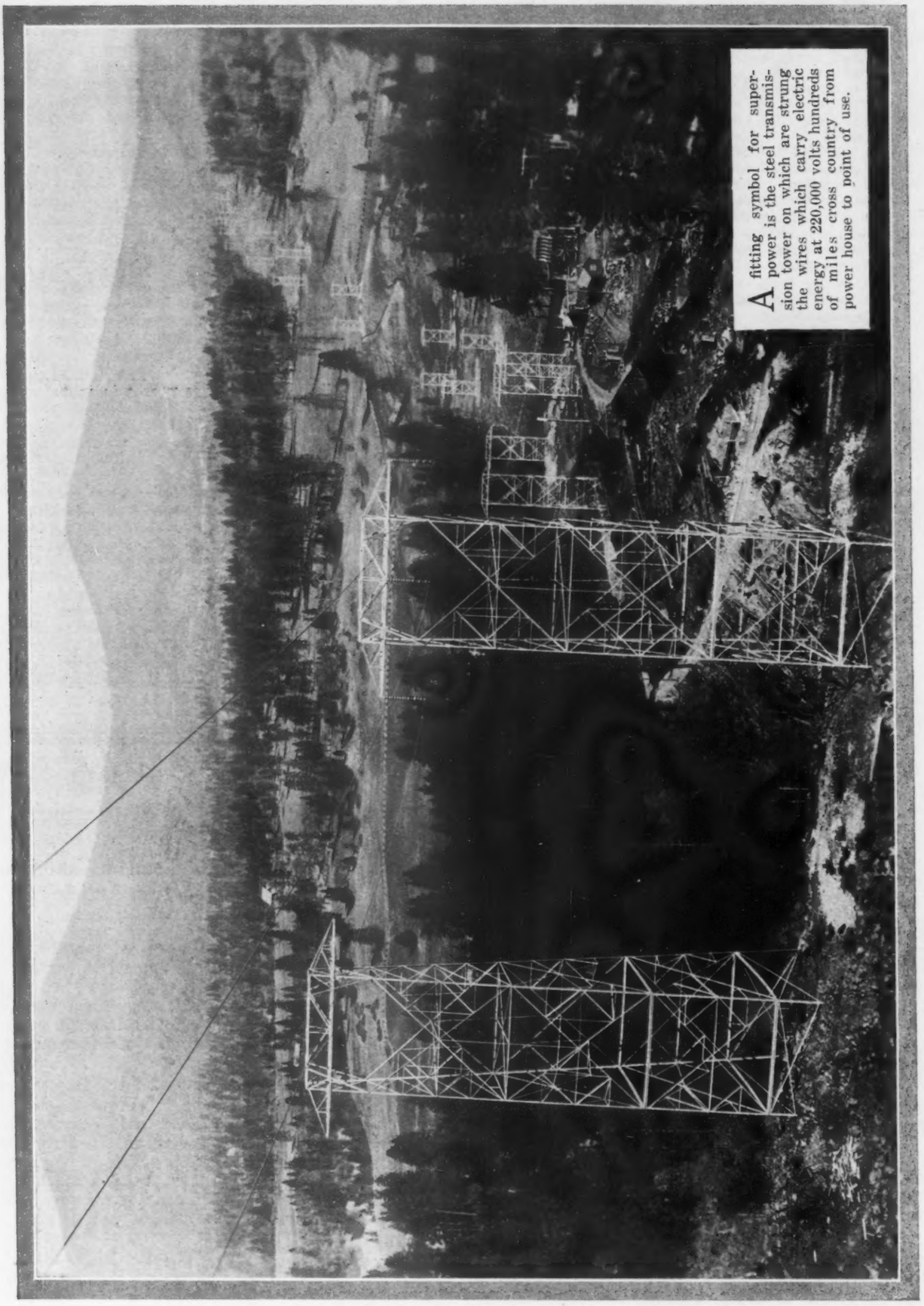
To the Editor:

Sir: Referring to your issue of July 15, 1923, Department of Electrical Construction, article by E. Earle Brown, page 57, paragraph beginning, "Using the last service example as an illustration . . . which would impose a load of 792 amp. on each of two conductors, 442 amp. on each of one conductor, 365 amp. on neutral conductor."

It seems to me there would be 427 amp. in each of the three phase leads, and in two of these there would be the single phase load of 365 amp. added or 792 amp. while in the single phase neutral there would be theoretically no load, or at most one-half of the total range load, that is, 182.5 amp., but for safety and rules we should put in a wire equal in size to the leads carrying the single phase load, or 365 amp.

W. M. HOLMES,
Southern California Edison Company.

Los Angeles,
Jan. 15, 1924.

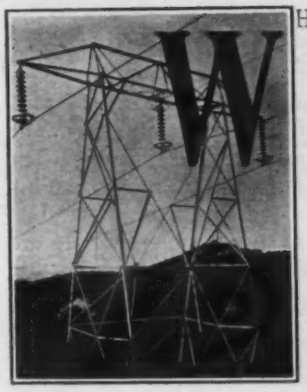


A fitting symbol for super-power is the steel transmission tower on which are strung the wires which carry electric energy at 220,000 volts hundreds of miles cross country from power house to point of use.

Superpower on the Pacific Coast

Means new industries, universal service and decentralization of industry and population. It is the open door to better living, and a powerful factor in our future social and industrial development.

By George C. Tenney
Managing Editor, Journal of Electricity



WHAT is this thing, "Superpower," that has aroused the attention of the nation? First, it is the mobilization of natural power resources and their development to the **nth** degree. It is another step forward in this age of electricity. Superpower, to the power engineer, means the systematic grouping and interconnecting of the already existing power systems to the end that greater economy will be effected. It means the creation of large capacity power trunk lines into which plants of a size not hitherto considered feasible will pour their power—lines which may be tapped so that every city, every town and finally, every rural district will share alike in the benefits afforded by an adequate and dependable supply of electric energy.

The chief merits of such a superpower system are that it will tend to stabilize rates for electric service and at the same time extend the uses of electric power; that it will tend to equalize the service and rates for power as between larger and smaller cities, so that the smaller towns and cities may build up industries and may progress parallel with the larger cities; that it will conserve coal, oil and labor.

The professional politician and demagogue are, at the present time, painting a picture of power in all its phases that is at variance with this idea of interconnection. They talk of a politically-owned kind of electric power that is going to act as a monkey gland to the antiquated machinery of the country, giving it new life and vigor and causing new industries to spring up where none grew before. What they are actually doing, or proposing to do, is to inject a slow and insidious poison into the existing system, to break it up into isolated units, in short, to undo the progress of a quarter of a century. Interconnection, and not the program which these short-sighted propagandists propose, will create new industries and ultimately bring about lower rates. It is the purpose of this article to show what interconnection has done and what superpower will do here on the Pacific Coast.

Secretary of Commerce, Herbert C. Hoover, a western engineer and one of the foremost champions of superpower, in his address before a conference of utility commissioners called for the purpose of considering the formation of a New England-Middle Atlantic Superpower Zone, said:

"This super development of large areas of cheaper power has been dramatized by those less familiar with the problem, as the construction of great power highways traversing several states into which we should pour huge streams at high voltages from giant water power or central steam-stations to be distributed to the public utilities and large users along the lines of these great power streams. This, indeed, serves perhaps to picture what is meant by superpower development. As a matter of practical fact, however, the natural development of this situation lies first in the interconnection of power supplies between the existing great utility systems, and, second, in common action for the erection of large units of production at advantageous points for the mutual supply of two or more systems and in the development of such great water powers as the St. Lawrence."

General Guy E. Tripp, chairman of the board of directors of the Westinghouse Electric & Manufacturing Company, also sums up the situation comprehensively. He says:

"When several water powers are interconnected, a considerable country is enclosed by the connecting transmission lines. By installing suitable service lines, electric service can easily be given to the whole area thus enclosed. With the water powers developed separately, however, the energy from each is inevitably sent to the nearest congested district, and the regions not actually traversed by the transmission lines are unable to obtain electricity except at a prohibitive cost. . . . With such a system, most of the now wasted water power . . . would be put to useful work, and though supplementary steam plants would be necessary, they would be called upon for a minimum amount of power and, since they would be of the largest and most efficient type, they would consume fuel with the highest obtainable economy. Furthermore, they would be established in the coal regions and at points of convenient access along the coast so that a large part of the railroad facilities now devoted to hauling coal would be released for other purposes. Both the power supplied by the water powers and the demand for electricity by the communities served would, of course, vary constantly, but the great network of transmission lines would act as an equalizing reservoir and would make up deficiencies at one point from surpluses at another. Thus are the views of the statesmen in agreement with conclusions of the engineer. Back of both lies one desire—to bring to the people of the United States and Canada the greatest possible prosperity."

Frank G. Baum, undoubtedly one of the greatest engineering authorities on superpower in the coun-

try, has laid out a nation-wide program for superpower systems in the United States. Mr. Baum has the following to say on the subject:

"Superpower means the mass production and transmission of kilowatt-hours, or the mass production and transmission of energy, to be distributed to many industries and communities for their needs and for the betterment of the conditions of mankind.

"A power system 'rents' out the use of its plant at different times during the day, week and year to the different users, just as a bank rents out its money to different users. The purely local demands on a bank may vary widely during different seasons of the year but the demands on all the banks of the country may be quite steady. The local seasonal demands caused great hardship and high interest rates before the organization of the Federal Reserve banks. The local demands on a power plant will, similarly, vary widely, but the demands on a large power system covering a wide area and supplying diverse industries, will be much more uniform, and therefore the large system can supply power more cheaply than can the small local plant. This diversity may be said to be the life of the power business. Thus large regional power districts interconnected to form a national power system may be compared to the regional Federal Reserve Banks that form the Federal Reserve Bank system.

"The successful railroad systems in the United States have emerged from the maze of railroad construction by the grouping together of parts of systems so related in territory that a very large and diverse traffic resulted in stable earnings. A further grouping into a few large systems is now contemplated and has been legalized by Congress. Similarly the successful electric power system has resulted or will result from systems covering very wide areas serving diverse industries and communities, in order to build up stable earnings and to give service at the lowest possible rates.

"Aside from the economies of such an interconnected power system, resulting from the 'banking' or mobilization of the power facilities, the power conditions throughout the area tend to become equalized, resulting in a distribution of population and industries not otherwise possible, in adding to the general stability of the country and in a great saving in capital and operating expenditures for the industries and cities served. In this problem of decentralization no doubt the electric power system will play a very important part, thus contributing to national stability."

One other man has expressed his opinions on the subject. Governor Pinchot of Pennsylvania, in a statement following the creation of a Superpower Committee by the legislature of that state, said:

"One reason why I am so interested in giant power is that it means enormously greater supplies of mechanical energy for our people. The more power per capita a commonwealth uses, the higher the place of that commonwealth in the scale of material civilization.

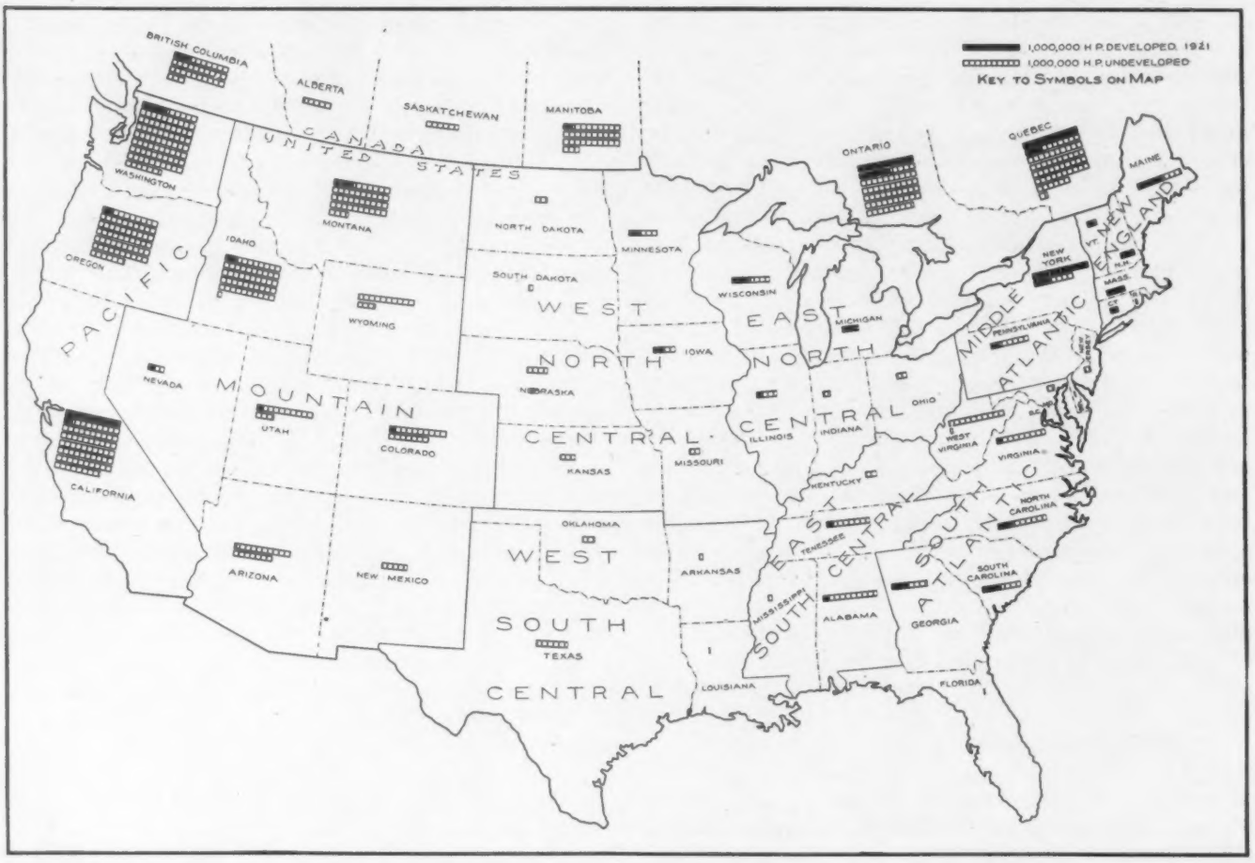


Fig. 1 showing developed and undeveloped water power resources of United States and Canada.

"Power means wealth, comfort, safety, progress. Great blocks of our people fail to get what they should out of civilization, because they are able to get and use far less power than they should.

"Giant power means that more people will get more power than ever before. It is the open door for better living to all our people, and that is true not only in Pennsylvania but of the whole United States."

Now, what relation does all of this national publicity and agitation for superpower have to those states west of the Rocky Mountains? Why should the electrical industry of these states, the business men and the people at large, concern themselves with schemes affecting the New England and Middle Atlantic states, Pennsylvania and the states bordering upon the Great Lakes? The first reason is that seventy-three per cent of the available water power resources of the country are situated in the Mountain and Pacific States. There is more than enough power available in the Columbia River and its tributaries and the Colorado and its tributaries to supply the future demands of the regions adjacent to these streams. If we on the Pacific Coast and in the Mountain states are to benefit to the highest degree from these enormous power resources, we must look to the East for a market for our surplus, for a long time at least. Fig. 1 shows the nation's water power resources.

But the fundamental reason for being interested in this superpower agitation is this: there exists right under our very noses, so to speak, an interconnected system—a superpower system, if you would call it that, which transcends the fondest dreams of those sections of the East which are now just beginning to discuss interconnection.

Picture if you can the network of interconnected transmission lines which covers California, Nevada and Oregon, extending from the Mexican border to the Columbia River. It has a generating capacity of approximately 1,850,000 hp. It serves a territory whose population is over 5,000,000. And it serves 1,214,000 consumers. In the Pacific Northwest there is an interconnected system which extends from Seattle to the farthest reaches of Montana. This system has a generating capacity of 720,000 hp. and serves 280,000 consumers. Between these two systems there are two short gaps whose total length does not exceed 25 miles. The electrical industry is planning to close these two gaps within the year. As a matter of fact, one of them is being closed at the present time.

The lines of the major companies serving Idaho and Utah are already connected, and the day is not far distant when all the transmission systems serving California, Oregon, Washington, Idaho, Montana, Colorado, Utah, Nevada and Arizona will be joined into one great system.

The assumption that such interconnection denotes common ownership is incorrect. One group which is agitating government ownership of hydroelectric utilities has characterized superpower as a "super trust." In no sense is this true. The same diversity of ownership which exists at the present time will be in no manner affected by the interconnection of adjacent power systems. Community of interests for the benefit of all consumers rather than common ownership is the goal toward which superpower aspires.

Physical features such as voltages, miles of wire, and generating capacity have little or no meaning to the layman. He wants to know what this interconnected system means to him, a business man in Yuma, Ariz., or in Spokane, Wash. Again quoting Mr. Baum, an illustrative analogy may make this plain:

"A superpower system compares favorably to a large bank in its economic function, and the electric medium of transmission may be compared to money, the medium of property exchange. If we had no money, then property would be the medium of exchange, but if we had money and no banks or depositories then the difficulties of conducting a business would be almost insuperable. Without a central distributing system each consumer must develop his own power and a surplus. There is no medium of exchange and there are no banking facilities. Electric transmission provides the electric medium for exchanging any one form of mechanical power to any other form at some distant point on the system.

"Now if one hundred isolated power plants were connected together by a transmission line and the power producing possibilities thus concentrated, we would then be able to supply the wants of the original one hundred consumers and have a considerable surplus. This surplus is principally due to the fact that the diversity of interests now supplied from the system are such that the system has a more uniform load, a better 'load factor' than the individual plants operating separately.

"Having connected the one hundred consumers by a single transmission system having a large power demand, we find we no longer can afford to operate the one hundred small plants supplying this energy, but by the construction of one or two large plants, we are able to supply the entire load at considerably less expense. At the same time power service is extended to all users alike by the large economic system."

The factors affecting this saving may be summarized as follows, according to Wm. B. Jackson:

"1. Saving in power house equipment made possible through taking advantage of the diversity of loads.

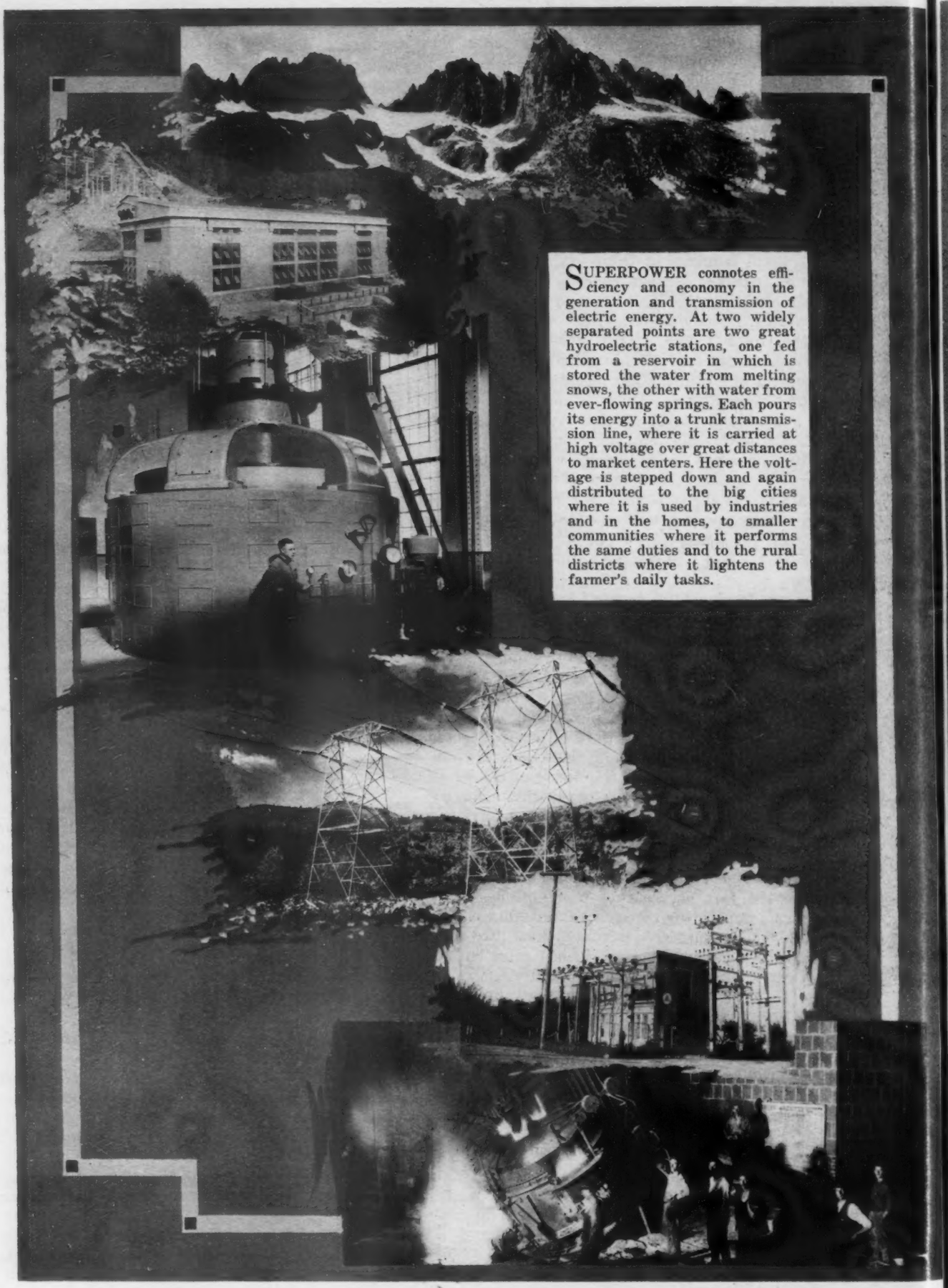
"2. Lower generating costs due to larger plants and improved load factor.

"3. Less investment per kilowatt of capacity due to larger plants as compared with smaller.

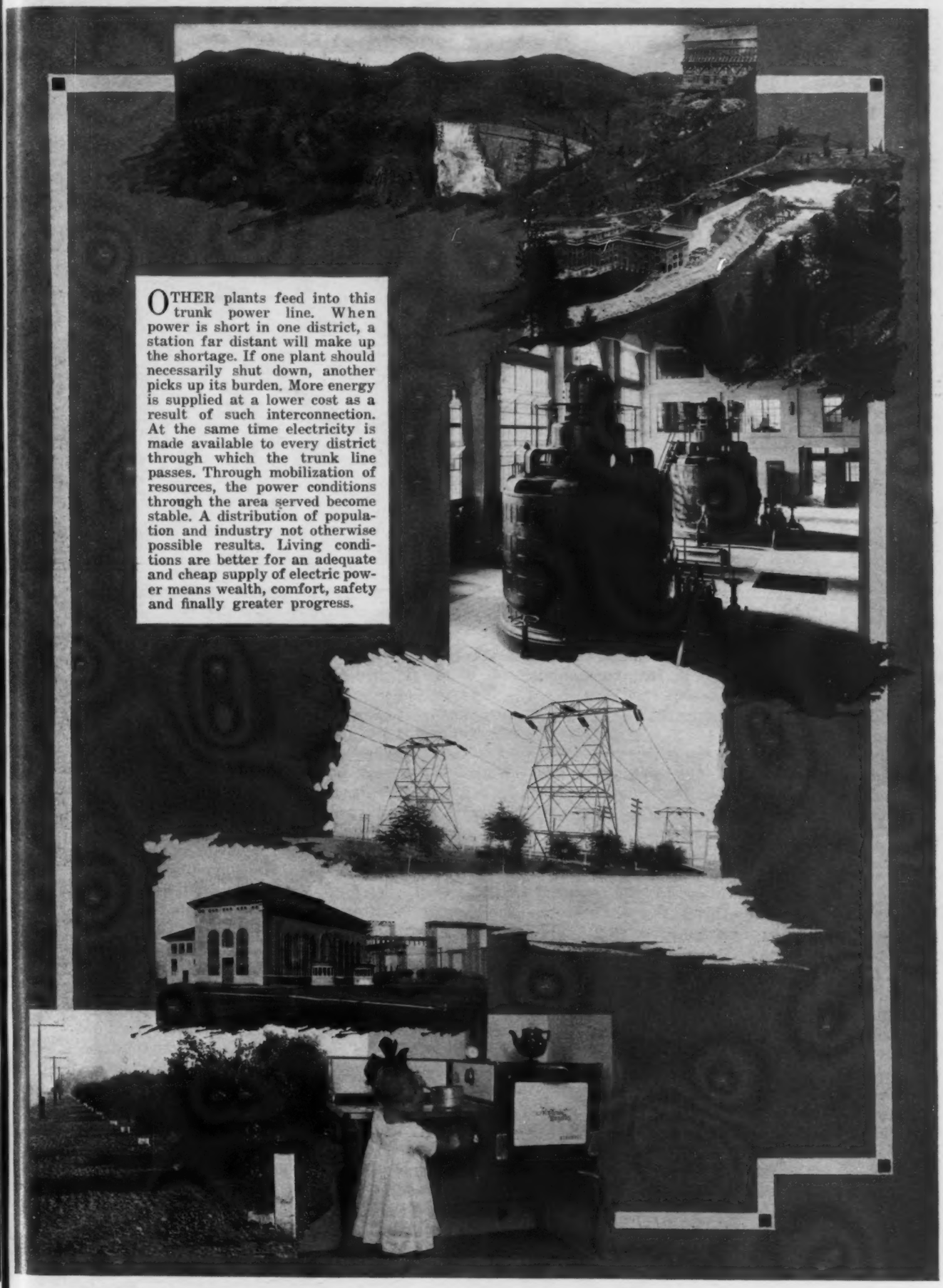
"4. The possibility of decreased percentage of spare apparatus due to a better arrangement of plants.

"5. Saving in cost made possible by centralized management, general superintendence and other expenses.

"6. The possibility of supplying other intermediate consumers at points between the original purely local plants.



SUPERPOWER connotes efficiency and economy in the generation and transmission of electric energy. At two widely separated points are two great hydroelectric stations, one fed from a reservoir in which is stored the water from melting snows, the other with water from ever-flowing springs. Each pours its energy into a trunk transmission line, where it is carried at high voltage over great distances to market centers. Here the voltage is stepped down and again distributed to the big cities where it is used by industries and in the homes, to smaller communities where it performs the same duties and to the rural districts where it lightens the farmer's daily tasks.



OTHER plants feed into this trunk power line. When power is short in one district, a station far distant will make up the shortage. If one plant should necessarily shut down, another picks up its burden. More energy is supplied at a lower cost as a result of such interconnection. At the same time electricity is made available to every district through which the trunk line passes. Through mobilization of resources, the power conditions through the area served become stable. A distribution of population and industry not otherwise possible results. Living conditions are better for an adequate and cheap supply of electric power means wealth, comfort, safety and finally greater progress.

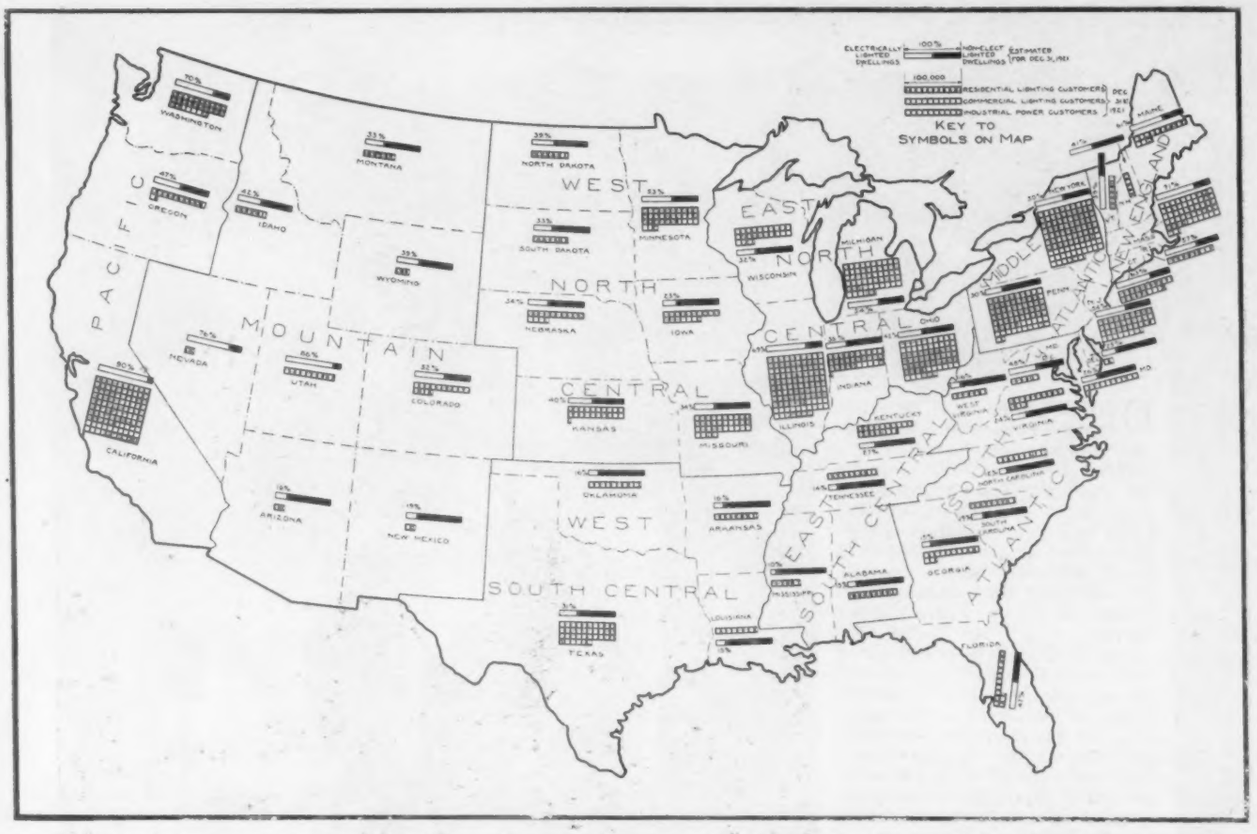


Fig. 2 showing electric consumers of all classes and percentage of wired homes for United States.

"7. The development of large and distant water powers to supplement the local fuel consuming plants."

In a few words, this summarizes the economic story of superpower.

But there is another side, which is ably demonstrated in our own region of interconnected power systems. Electric service is essentially the same on the Pacific Coast in cities of 5,000, of 50,000 or of 500,000 population. Universal service has been the watchword of those men who have pioneered these systems. The result has been that the same service rendered in a large city is available to mining camps in the mountains and to the farms, the small towns and the small industries. This has resulted in a distribution of population and industries in California not otherwise possible and very often it has resulted in establishment of a small factory, a rock quarry, a cement plant or a farm at a point not otherwise economically feasible, thereby adding to the general prosperity of the region.

As an example, let us consider the case of a small cotton mill in Virginia. It is located in the mountains on a small branch railroad line. Its raw product, cotton, comes largely from Louisiana and Texas, and its finished product, cotton fillers for sugar sacks, etc., is shipped to California and elsewhere. The plant is located at this isolated point because there is water power available at that site. Uneconomical arrangement, you must grant, but necessary at the time the factory started. Imagine the saving that might be effected were the plant located at either the source of the raw material or at the point of utilization of the finished product, with power supplied by a high tension line which brings the energy to run the machinery from a large water power plant on the banks of a river many miles away.

The following quotation from the "Electrical World" explains this point more fully:

"The transportation of electric energy is the least of the transportation problems which today confront industry. A new manufacturing center means new difficulties in the accumulation and distribution of material vastly more troublesome than any electrical distribution which would tend to place the plant in a better situation as regards the transportation marked as a whole. Further it is undoubtedly desirable to check the extreme centralization of industry which is now going on. It would be much better to distribute the work over fifty towns and cities than to concentrate it in one of them, where, inevitably high expense, a difficult labor situation and overcrowding with all its attendant misfortune, will hold sway. To be perfectly frank about it, a large industrial city is usually by no means a pleasant place in which to live, rarely well governed and almost universally over-taxed. In this civic sense the work of the distribution system which brings cheap power to the country at large, instead of confining it, as now too often happens, to a few big centers, is of primary importance."

In the last analysis, what is the measure of the efficiency of our electric service on the Pacific Coast? Is it not in the number of homes we have reached

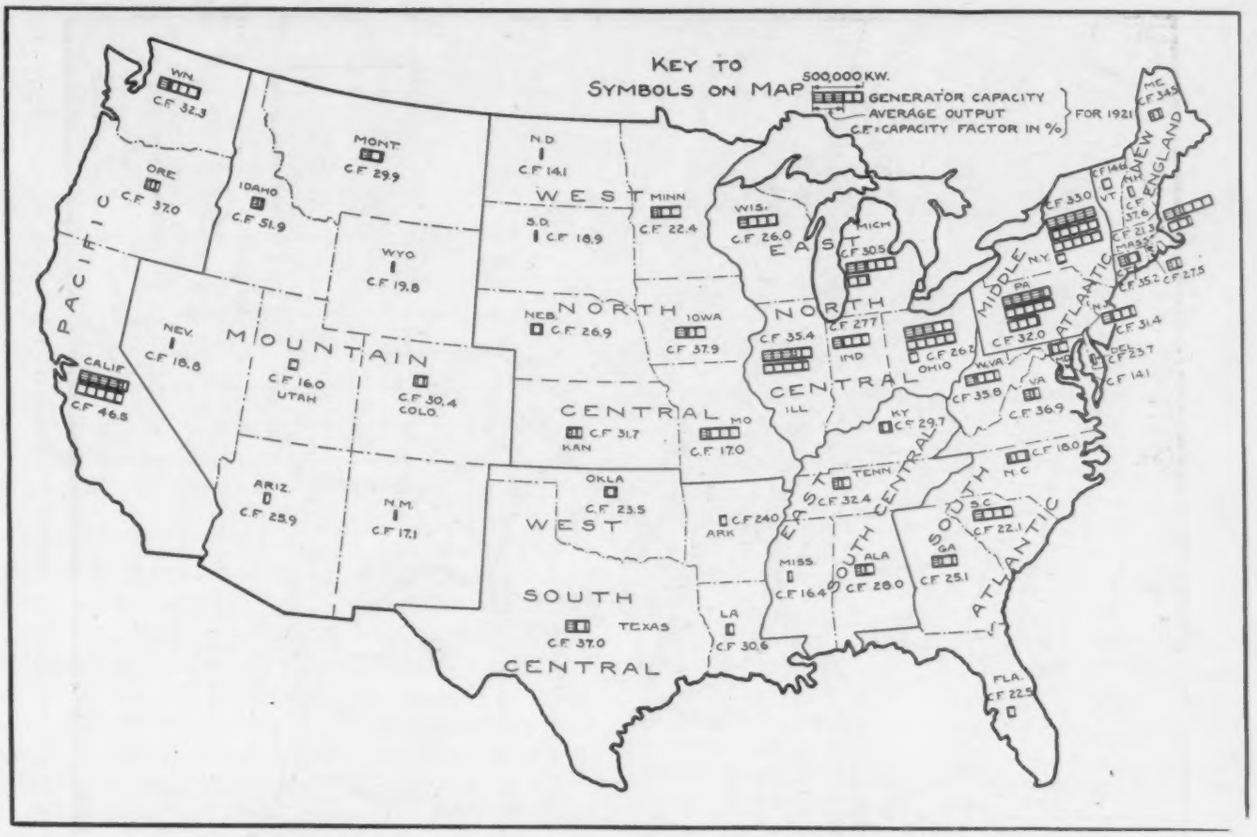


Fig. 3 showing generator capacity, average output and capacity factor for United States.

and in the extent of which we are availing ourselves of the natural advantages of our power resources? Fig. 2, which is taken from Mr. Baum's "Atlas of U. S. A. Electric Industry," shows the percentage of wired homes for every state in the Union as well as the number of electric consumers of various classes. Regarding this chart, Mr. Baum says:

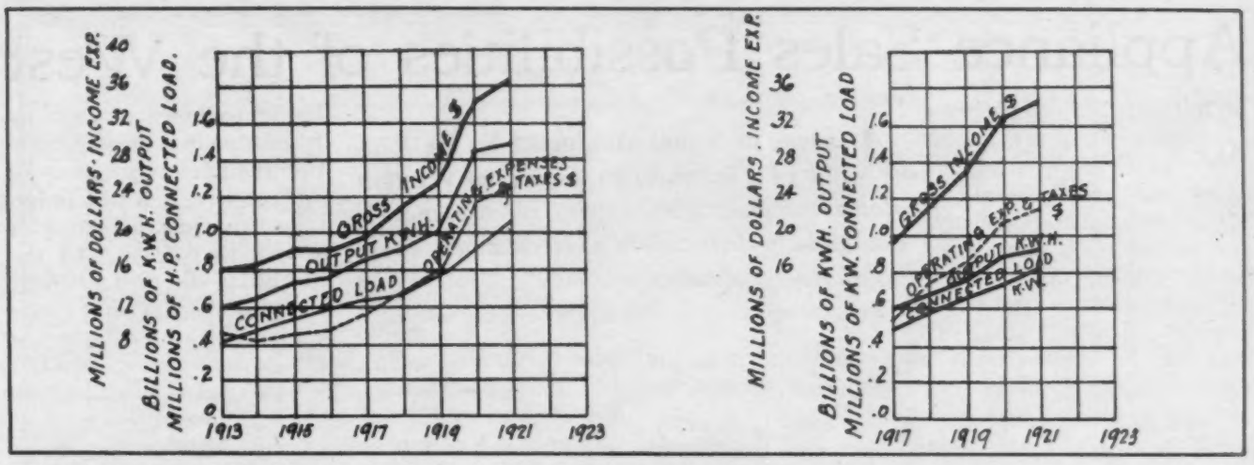
"Out of the total of 11,000,000 electric consumers, California has more than 1,000,000 or one for every 3.5 persons, whereas in the United States there is approximately one customer for every 10 persons. California has about 9 per cent of the total residence customers, 10 per cent of the total commercial customers and 15 per cent of the total industrial customers compared with 3.5 per cent of the population. The most surprising showing, however, is that California has 64,000 industrial consumers as against 42,600 for Illinois, 30,500 for Pennsylvania, 27,350 for Ohio and 25,550 for New York."

The degree of efficiency of utilization of our power resources is indicated by the capacity factor (the ratio of the average load to the total installed capacity of the generating plants, which is really a measure of efficiency of plant investment. Fig. 3 which is also taken from Mr. Baum's "Atlas," shows that California with a capacity factor of 46.5 and Idaho with a factor of 51.9 lead all other states of the Union by far. It will be noted from the map that Missouri has a capacity factor of 17 while South Carolina, one of the states in the proposed Southeastern Superpower Zone, has a factor of 22.1. This means that California is producing almost 3 times as much energy as Missouri and twice as much as South Carolina for each horsepower of installed generating capacity. The reason for this is obvious. Interconnection of the large power systems in California has made possible these remarkable economies. And it is safe to say that if the two 220,000-volt transmission lines operating in northern and southern California were interconnected so that there might be a free flow of very large blocks of power, uninterrupted, as Secretary Hoover says, by state and municipal boundaries, this capacity factor could be made to approach the load factor for the two systems or the state.

Right here it might be well to point out one of the greatest dangers of the municipal projects such as are already under way for Los Angeles, Seattle, Tacoma and San Francisco and which are proposed for Sacramento and other Pacific Coast cities. The uninformed politicians who are sponsoring these projects are breaking down this great economic interconnected power system which has been twenty-five years in the building, creating in its stead a number of isolated systems serving their particular cities. By so doing they will turn back the wheels of electrical progress twenty years. They will place California and other states on the Pacific Coast in the position of those eastern states which are just now recognizing the benefits to be derived from superpower and are making for the earliest possible creation of large power zones.

To use again the analogy of the bank, the short-sighted politicians would create a series of small

This map, taken from Mr. Baum's "Atlas of U.S.A. Electric Power Systems," shows the network of proposed national superpower lines with relationship to existing systems.


MILLIONS OF DOLLARS · INCOME EXP.
BILLIONS OF K.W.H. OUTPUT
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GROSS INCOME $
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OPERATING EXPENSES & TAXES $
1913 1915 1917 1919 1921 1923
MILLIONS OF DOLLARS . INCOME EXP.
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MILLIONS OF KW. CONNECTED LOAD
GROSS INCOME $
OPERATING EXP. & TAXES $
OUTPUT K.W.H.
CONNECTED LOAD K.W.
1917 1919 1921 1923

Fig. 4 showing relationship between large interconnected system (on left) and system of similar size made up of small isolated units (on right).

isolated banks, each with its own medium of exchange. No sane business man would recommend the decentralization of the national banking system or the destruction of the Federal Reserve system and the creation in its stead of local banks with no standards of currency and no means of exchange. Such retrogression is preposterous, yet political propagandists seek to undermine the economic structure of our electrical system which has proved sound under every test, and to demobilize the power resources which interconnection makes available.

Fig. 4 demonstrates this point. It compares the interconnected system of one large company operating in one state and serving two hundred communities with 1,500,000 population, with the system of another company made up of small scattered units in 17 states serving almost the same number of communities with 2,250,000 population. It can readily be seen that for the same gross income, and with approximately the same operating expense and taxes, the interconnected system is furnishing 65 per cent more energy than the system made up of isolated units, thus showing the economies of the large concentrated system. Is it any wonder, then, that the interconnection of the power systems on the Pacific Coast insures the greatest possible conservation of our water resources, guarantees the maximum dependability of power supply and results in an economy which reflects itself in the widest possible service and the lowest average energy rate consistent with the character of service rendered?

Nor is it to be imagined that state ownership would prove a panacea for the ailments which the politicians and yellow press ascribe to existing power systems. It is reasonable to believe that so long as our present method of government continues, the large city will dominate any commission or board which might be elected or appointed to administer the affairs of a state-owned power system, to the detriment of both smaller city and farmer alike.

What of the men who have pioneered and made possible this superpower zone here on the Pacific Coast and elsewhere? Secretary Hoover, in his plea for superpower, paid them a high tribute when he said:

"It is fitting that I should make some remark upon the progress and ability shown by the whole electrical industry since the days of Mr. Edison's initial genius. They have come to have a large vision of cooperation and service and have in a very large measure realized their responsibilities to the public. One great mark of their progress is, that despite the greatly increased cost of labor, coal, oil and other materials, there is but little, if any, increase in the cost of light and power to the consumer today over pre-war prices. Under the protection of state regulatory bodies over 2,000,000 of our people have invested their savings in this industry. From an annual utility production of four billion kilowatt-hours twenty years ago we have increased to fifty billions today with an increase in consumption from 60 to 500 kw-hr. per capita. It is a magnificent achievement of the initiative and ingenuity of these industries, and that it has attained such a growth under public regulation is itself proof of the ability and cooperation of our public officials. I believe that the same vision applied to the wider problems which spread before us will maintain the same initiative and secure like progress in the future."

Superpower is not visionary. Here on the Pacific Coast it is an accomplished fact, not perfect by any means, but fast approaching a stage of perfection that will be reflected in greater economies and a more universal use of electricity. There will be no more important factor in our future industrial and social development than cheap, abundant and dependable electric energy. Few other factors have more important social relations or give greater promise, by the progressive substitution of mechanical for manual labor, of raising the economic level and improving the social status of this country. And superpower, administered by that same private initiative and public regulation that has fostered and developed it to its present state of progress on the Pacific Coast, will do all these things. The men who are doing this work are doing a public service of the highest order. Why change?

Appliance Sales Possibilities of the West

A survey of homes conducted by the Journal of Electricity in the eleven Western states discloses the extent of the market available to distributors of electric household appliances and supplies.

CHILDREN sometimes have what are called "growing" pains, pains that are incident to rapidly increasing stature and girth. Countries also have growing pains, and sections within countries likewise. These "pains," if they may be so called, find their reactions within the machinery of commerce, when the demand outstrips the ability to fill that demand.

The good old days when everybody in a community knew everybody else in that community by his or her first name have practically disappeared. Local distribution of the most primitive sort, with its general merchandise store has been succeeded by nation-wide distribution with its multiplicity of agents, district offices, jobbers, retailers and special representatives.

It is a far cry between the stocking of staples in the general store to meet the simple need of the small community to the market survey with its wealth of statistics upon which the great industrial organizations of today base their sales campaigns for a given period of time.

To a greater and greater extent as time goes on, the business paper has delved deeper into the economics of the industry that it serves, in order to render an increasingly valuable service to its clientele. Only a few of the larger industrial organizations have the facility to undertake market surveys on their own account. By far the great majority of concerns operating within a given field rely upon their business paper for a periodic market analysis, for the general statistics of their industry, in short for the data upon which they may forecast, with reasonable accuracy, the volume and kind of business in store for them during the forthcoming year.

Conforming to its usual practice, the Journal of Electricity has made a market survey dealing essentially with the domestic market for electrical appliances within its geographical field, the eleven Western states. In all, a period of more than three months was required in seeking and compiling the data gathered from many sources.

The method followed was that of the questionnaire. A list of several thousand names was compiled from residences given in the telephone directories covering both urban and suburban localities in each of the eleven Western states. The number of questionnaires was proportioned to population in each state, in order that a cross-section as nearly accurate as possible might be obtained that would disclose the actual situation in the various localities surveyed.

It is regrettable that these data are not available from official or governmental sources. Some day some department of the government, the Department of Commerce, for instance, will recognize the importance of such information in contributing to the industrial progress of our country, and will undertake this work as a matter of public welfare. In the meantime the responsibility has devolved upon private enterprise, which does the best it can with such means as are at its disposal.

It may be said at this time that the response to the Journal of Electricity questionnaire was unusually good. Every possible means was taken to bring about this result. Every householder addressed was assured that he or she would not be quoted; the reason for making the survey was given clearly and concisely. Stamped, self-addressed envelopes were enclosed with each questionnaire in order to reduce the resistance to the request to the lowest possible point. In cases where questionnaires were returned uncalled for, additional names were used in order that the proper proportion of names to population might be maintained.

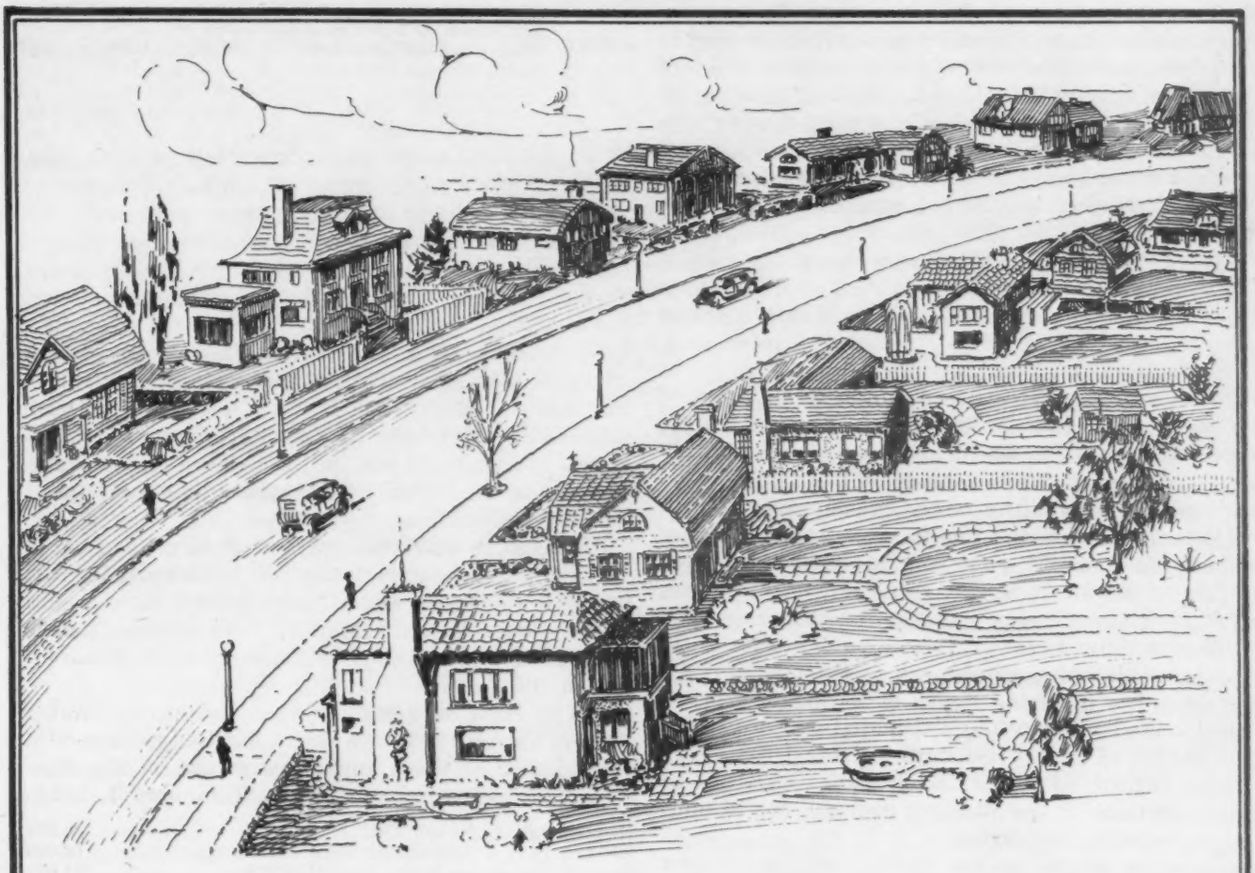
From the data received, a tabulation, presented here, shows the number of electrical appliances per hundred wired homes in California, and in the eleven Western states. As was to have been expected, the greater electrical development in California, as compared to the eleven Western states as a whole, has brought about a correspondingly greater use of appliances, the difference in some cases being as great as 50 per cent in favor of California.

Howard A. Lewis, business manager of Electrical Merchandising, divides electrical merchandise into four classes:

1. Staples and necessities
2. Vogue, style or fad items
3. Specialties
4. Pioneer or exploitation items.

This classification by Mr. Lewis is exemplified in an interesting manner in the figures prepared. The electric iron, one of the pioneers in electrical appliances, shows no less than 110.6 irons per hundred wired homes, or slightly in excess of one iron per home, while the number of pioneer or exploitation items such as the electric range, the dishwasher and similar appliances are but slightly in excess of one per hundred homes. Not the least interesting item of comparison is that of the range, which in California shows but 1.3 per hundred homes, while the number in the eleven Western states is 4.4 per hundred homes. This is probably due to the fact of the great quantity of gas used for cooking in population centers within California, a type of fuel not available to nearly so great an extent in the other less thickly populated Western states. Gas competition would appear to be an item of no small importance in the pioneering of electric ranges.

The vacuum cleaner seems to have made a very strong appeal to households in the comparatively few



Of Every 100 Wired Homes

IN THE WEST—	IN CALIFORNIA—
19 have Air Heaters	29 have Air Heaters
4 have Chafing Dishes	5 have Chafing Dishes
22 have Curling Irons	23 have Curling Irons
6 have Disk Stoves	7 have Disk Stoves
1 has Dishwasher	1 has Dishwasher
1 has Electric Cooker	1 has Electric Cooker
6 have Electric Toys	9 have Electric Toys
86 have Flatirons	110 have Flatirons
16 have Fans	19 have Fans
28 have Floor Lamps	27 have Floor Lamps
14 have Grills	24 have Grills
3 have Hair Driers	3 have Hair Driers
1 has Immersion Heater	2 have Immersion Heaters
3 have Ironers	4 have Ironers
2 have Milk Warmers	3 have Milk Warmers
1 has Mixer	1 has Mixer
34 have Percolators	43 have Percolators
10 have Radio Sets	10 have Radio Sets
4.4 have Ranges	1.3 have Ranges
1 has Samovar	1 has Samovar
11 have Sewing Machines	14 have Sewing Machines
32 have Table Lamps	24 have Table Lamps
44 have Toasters	62 have Toasters
5 have Utility Motors	4 have Utility Motors
53 have Vacuum Cleaners	66 have Vacuum Cleaners
14 have Waffle Irons	18 have Waffle Irons
14 have Warming Pads	20 have Warming Pads
30 have Washing Machines	35 have Washing Machines

years of its existence. No less than 66 vacuum cleaners per hundred wired homes are now used in California, while the number for the eleven Western states as a whole is only slightly below this, being 53.

The toaster and the percolator seem to rank next in the order of their popularity, with 62 and 43 per hundred wired homes in California, respectively, and 44 and 34, respectively, as the number in the eleven Western states.

In any event, the figures demonstrate conclusively that the saturation point is remote, even though the population in the eleven Western states were regarded as stationary instead of increasing, as it is, more than 5 per cent per annum.

The sale of electrical appliances is an effect of the increase in the development of central station power. This is the basis upon which reasonably accurate forecasts may be made as to existing markets and the possibilities of the continuation of such markets in the future. The increase in the number of domestic consumers for central station power in the entire eleven Western states during 1923 was 187,827. The estimated increase for the same type of consumer for 1924 is 196,697, while the total anticipated domestic consumers at the end of 1925 aggregate the imposing figure of 2,093,580. These figures have been carefully estimated and are based upon the curve of increase during the last five years without regard to abnormal building activities in certain sections of the Western country, nor to unusual increases in population.

A survey made by the central stations shows approximately one kilowatt connected for every residential consumer; therefore, outside of the small percentage of penetration shown by the existing load, which in itself offers a market for domestic appliances of great proportions, there is the further market due to the increased connected load for new consumers and newly wired homes that reaches almost unbelievable proportions.

It should not be overlooked at this juncture that there is a great deal more involved in this question of markets than the sale of appliances, for with each such sale is carried a job for the contractor and the sale of wire, conduit, switches, convenience outlets and fixtures of all sorts. The sales possibilities as exemplified by community growth are illustrated in the table following:

	Total Domestic Consumers Dec. 31, 1923	Estimated Increase Domestic Consumers for 1924	Estimated Total Domestic Consumers Dec. 31, 1924
California	944,453	123,547	1,068,000
Oregon	144,650	13,150	127,800
Washington	259,650	33,950	293,600
Idaho	45,600	1,300	46,900
Montana	41,250	240	41,490
Utah	86,100	3,500	89,600
Wyoming	22,100	2,350	24,450
Colorado	134,800	15,200	150,400
New Mexico	16,740	1,240	17,880
Arizona	17,900	1,190	19,090
Nevada	16,950	1,030	17,980
Total	1,700,193	196,697	2,093,580

Generally speaking, it would appear that three classes of prospective buyers offer themselves to electrical industry:

1. That class which already has one or more appliances and which is a prospect for many others.
2. That class which already lives in wired homes, and which has no appliances.
3. That class that is building new homes, which of course will be wired, and that are potential purchasers of appliances.

Unusual interest seems to attach to the exploitation of the electric range. From the viewpoint of the central station, it constitutes a most desirable type of load and when the convenience of electric cooking has been thoroughly presented to the many thousands of potential purchasers there is no doubt but that this appliance will supersede the gas range in practically all of the better class of homes and apartment houses. This appliance is at present in the pioneer stage; the market has scarcely been scratched. With only 1.3 ranges per hundred wired homes in California and only 4.4 in the eleven Western states, this field would appear to offer almost limitless possibilities.

The same markets apply in a large degree to electric water heaters, with 0.8 per hundred wired homes in California and 1.3 per hundred wired homes in the eleven Western states. This market, too, is still in the pioneer stage with its greatest possibilities in the future.

The sales of electric ranges and electric water heaters during 1923 have been tabulated as have also the number of these appliances in use on the lines of central stations, reporting as of January 1, 1924:

Electric ranges in use Dec. 31, 1922	35,537
Electric ranges sold during 1923	18,000
Electric ranges on lines, Dec. 31, 1923	53,537
Electric water heaters in use Dec. 31, 1922	14,218
Electric water heaters sold during 1923	8,129
Electric water heaters on lines, Dec. 31, 1923	22,347

These figures show that only 4.4 per cent of the consumers own electric ranges and only 1.3 per cent of the consumers own electric water heaters.

The sales resistance to the electric range and the electric water heater is two-fold, the first on account of the relatively high first cost as compared to other devices for rendering the same service, and, second, the impression that seems to be prevalent that the operating cost is high. To these might be added a third item, namely, that of lack of familiarity with the operation of these devices and a certain amount of suspicion if not fear of these particular applications of electricity.

These conditions are being gradually overcome. The speed with which they are overcome will depend very greatly on the degree of intelligence shown by the sales methods used, and by the quality of the servicing after installation, with this latter item being one of the most important.

It is astonishing to find, in spite of our boasted superiority in all things electrical, that of the wired homes in California 18.6 per cent have no convenience outlets, while for the eleven Western states 19.4 per cent are in the same condition. It seems incredible that this should be so in a territory that has had relatively small competition from coal and wood for heating. The industry has recognized for a long while that the convenience outlet is almost essential to the satisfactory use of nearly all lamp socket

appliances. It appears, therefore, that much work remains to be done by the industry in selling consistently and persistently the convenience outlet idea. The average number of convenience outlets per home is only six and 37.8 per cent of the total number of homes examined have less than this small average.

An industry so great in its scope as that covering the manufacture and sale of electrical appliances must inevitably become more and more highly specialized as time goes on. Since the market is large enough to justify specialization, great progress is to be expected in the way of improvements in devices with the idea of a greater economy in operation, facility in making repairs and to render them simpler and more nearly fool-proof to suit the average household.

Perhaps the best augury for the future is the tendency on the part of the many diversified interests that go to make up the electrical industry to recognize their interdependability and to discuss their mutual problems with one another. The favorable rates for electrical energy for domestic service that obtain in the West have been one of the chief, if not the chief factor, influencing the increased use of electrical appliances. Lamp socket devices have increased greatly in popularity backed by promotion efforts of the central stations, but the same thing is true of the heavier, more expensive appliances such as ranges, water heaters and air heaters. Special combination rates are made for each. All of the energy used in the home may be purchased through a single meter. The steps or rates of decrease in these rates have been so devised as to stimulate the increased use of electricity by making it possible that the major portion of the energy may be purchased at relatively low cost.

There has been considerable debate on the part of leaders in the industry as to whether electricity should be classed as a neccessity or a convenience. For lighting and communication it has come to be practically a necessity, although, speaking literally, it is undoubtedly true that we could burn candles, give up the telephone and revert in a way to the primitive lives of our forefathers. Electric cooking, however, is a convenience that needs only the proper kind of educational work with the housewife in order to bring it into as close an approach to the necessity class as the electric light and the telephone. Competition with gas and oil, especially for the larger homes and apartment houses, is difficult for electrical leaders to combat. On the other hand, the smaller homes would appear to offer the more promising field for the reason that in these homes there is no waste area to speak of, no empty halls or unoccupied rooms to heat, and comparatively small, and in some cases very small, radiation losses.

In any event, the advice given by Horace Greeley to the young man has never been more appropriate than now. The statistics on building operations for 1923 and the prediction that these figures will be increased in 1924 show the Western country and particularly California as the fastest growing section of the United States; indeed, the central stations, the manufacturers and dealers will have to hustle to keep pace with this growth. Much of the new population is coming from the Middle West, a section of the country where electric lights in many cases are still regarded as very much of a luxury, where the toaster, waffle iron, percolator, vacuum cleaner, and countless other electric servants in the household are practically an unknown quantity. These household conveniences, the facility with which they can be installed, the cheapness of their operation are not the least of the many attractions that the Pacific Coast section offers to those who are coming here to make their homes.

The history of electric rates is showing a steadily downward tendency. The average rates for domestic consumption as well as for industrial and commercial purposes are lower than those for any other section of the country. There is no doubt whatever that the time will come when this Western country of ours will be literally one great electrified industry conducted by those who live in one great electrical home. The length of time this will take will depend entirely on the degree of energy, skill and constructive thought put into this project by those who today make up the electrical industry of the West.

Restoration of Japanese Telegraph System Nearly Completed

Rapid progress has been made, according to the Japanese press, in the re-establishment of telegraph service throughout the earthquake area, stocks of telegraph wire at Osaka and Shibaura being available for immediate use in repairing the damaged lines. The telephone system, on the contrary, has suffered severely and its complete restoration will require at least three years, according to advices to the Far Eastern Division of the United States Department of Commerce.

In the Fukagawa and Honjo wards which were completely devastated by fire, it was found that the underground wires and cables had sustained only a limited amount of damage, so that the restoration of this section will be accomplished in a shorter period than was expected.

The telephone exchanges at Koishikawa, Aoyama, Ushigome and Yotsuya, serving altogether about 20,000 telephone users, have been reopened since Sept. 29. These four exchanges were saved from the conflagration, though the Yotsuya office was badly damaged. The telephone authorities expect to open a big exchange in a central section of the city this spring, increasing the number of phones by about 10,000. This is, however, a makeshift arrangement, the permanent measures for a complete restoration of the communication system having been left for determination after the main city reconstruction program is settled. At the same time it is said that the manual system hitherto used will be supplanted by an automatic system. The Department of Commerce reports that an unusual opportunity exists in Japan at the present time for the introduction of American-made automatic telephone equipment.

MAJOR Western hydroelectric plants finished in 1923. Reading from top to bottom the plants are: (left) Powerdale, Pacific Power & Light Company; American Falls, Idaho Power Company; (right) Big Creek No. 3, Southern California Edison Company; Don Pedro, Modesto-Turlock Irrigation District; El Dorado, Western States Gas & Electric Company.

Survey Shows 1924 Will Be Record Year for Hydroelectric Development

HYDROELECTRIC projects in the West completed during 1923 involved a total of 143,325 kw. while those which will be completed during 1924 will add 251,600 kw. to the lines of the companies serving this rapidly growing territory. In round numbers the 1923 program represented an expenditure of $58,800,000 while the 1924 construction will represent an estimated expenditure of $103,000,000 for additional generating capacity, including plants, transmission and distribution equipment.

With the 138,675 kw. made available during 1922, the average annual increase in hydroelectric capacity during the three-year period, 1922-4 inclusive, is 177,663 kw. or at the rate of approximately 10 per cent a year on the basis of an installed hydroelectric capacity of 1,857,500 kw. at the end of 1923. In the case of California alone the average annual increase over a three-year period has been 116,075 kw. or at the rate of 12 per cent on an installed hydroelectric capacity of 967,500 kw. Dec. 31, 1923. Should this percentage of increase hold for the next five years, the installed hydroelectric capacity of the West at the close of 1928 would be approximately 3,000,000 kw. while that of California would be slightly in excess of 1,700,000 kw.

It is reasonable to believe that the increase in population and industrial activity in those states west of the Rocky Mountains during the next five years will equal if not eclipse that of the past. Already one company in California is making plans for serving 6,000,000 people within the next ten years in a territory where it now serves but 2,000,000.

The increase in steam generating capacity during the past year has been almost negligible. There have been a few plants completed in the Pacific Northwest. However, there are planned for the coming year several notable installations. These include a 70,000-kw. plant for the Southern California Edison Company at Long Beach; the initial unit of 25,000 kw. in a new plant for the Los Angeles Gas & Electric Company; a 20,000-kw. plant for the Utah Power & Light Company at Salt Lake City; a 20,000-kw. unit in a plant which will have an ultimate capacity of 200,000 kw. for the Public Service Company of Colorado at Boulder and a 5,000-kw. plant for the Mountain States Power Company at Coos Bay, Ore. The present installed steam capacity for the eleven western states is 716,125 kw. while that for California alone is 410,000 kw.

The past twelve months have witnessed some notable additions to the hydroelectric generating stations of the West, chief among which is the Big Creek No. 3 plant of the Southern California Edison Company on the San Joaquin River. This station has an initial capacity of 75,000 kw. and an ultimate capacity of double this figure. The Edison company's program also included the installation of a third 16,000-kw. unit in Big Creek No. 1. The Modesto-Turlock Irrigation District completed a 15,000-kw. station at Don Pedro dam on the Tuolumne River in California in connection with its irrigation project. The Western States Gas & Electric Company also completed its 20,000-kw. El Dorado plant on the American River.

In the Mountain states the Utah Power & Light Company added the fourth 11,000-kw. unit to its Grace plant in Idaho, while the Idaho Power Company has completed the installation of two 6,000-kw. units at its American Falls plant on the Snake River. The only station of any size to be completed in the Pacific Northwest during the past year was the Powerdale plant of the Pacific Power & Light Company near Hood River, Ore. This plant has a capacity of 6,000 kw.

A survey of hydroelectric projects under way during 1923 or definitely scheduled for 1924 is contained in the following table:

Name of Company	Plant	Location	Present or Proposed Installation kw.	Ultimate Capacity kw.	Static Head (ft.)	Present Stage of Development
British Columbia Electric Railway Company	Stave Falls (fifth unit)	On Stave River near Vancouver, B. C.	18,000	18,000	110	Construction nearing completion. Plant to be in service Oct. 1, 1924.
British Columbia Electric Railway Company	Alouette	Near Stave Lake, B. C.	9,000	9,000	140	Awaiting Government approval.
Puget Sound Power and Light Company	White River (fourth unit)	Dieringer, Wash.	16,000	57,000	440	Plans completed and equipment ordered.
City of Seattle	Gorge Creek	105 mi. N. E. Seattle	35,000	480,000	270 (Initial) 375 (Ultimate)	First unit 88 per cent complete.
City of Tacoma	Cushman	North Ford of Skokomish River, Wash.	36,000	101,000	140 (min.) 260 (max.)	Ready for bids on dam and tunnel. Plans and specifications for power house and equipment being prepared. Plant to be in service January 1, 1926.
Pacific Power & Light Company	Powerdale	Near Hood River, Ore.	6,000	6,000	180	Completed May 15, 1923.
City of Aberdeen (Wash.)	Wynooche	Wynooche River, Wash.		20,500		Bond issue of $2,000,000 for this development passed December 1, 1923.

Name of Company	Plant	Location	Present or Proposed Installation kw.	Ultimate Capacity kw.	Static Head (ft.)	Present Stage of Development
Washington Water Power Company	Long Lake (fourth unit)	Long Lake, Wash.	17,400	70,000		Equipment delivered. In service 1924.
Washington Water Power Company	Similkameen (second unit)	Oroville, Wash.	1,600	3,200		Completed, 1923.
Idaho Power Company	American Falls	American Falls, Idaho	12,000	27,000	50	Two 6,000-kw. units put in service, one each in December 1923 and January, 1924.
Montana Power Company	Mystic Lake	Mystic Lake, near Columbus	10,000	10,000	1,050	One-third completed. Plant to be in service by end of 1924.
Utah Power & Light Company	Grace (fourth unit)	Grace, Idaho	11,000	44,000	525	Fourth unit added and put in service in 1923.
Utah Power & Light Company	Soda Springs	Bear River, near Alexander, Idaho	14,000	14,000	78.5	Plant 50 per cent completed. To be in service July, 1924.
Mountain States Power Company	Albany Hydro	Albany, Ore.	1,000		34	To be completed March, 1924.
Mountain States Power Company	Big Fork Hydro	Big Fork, Mont.	1,700		110	Construction started early in 1924.
Deschutes Power Company	Cove (second unit)	Crooked River, near Culver, Ore.	875	2,150	31	Work 10 per cent completed.
Portland Railway, Light & Power Company	Oak Grove	Upper Clackamas River, Ore.	30,000	90,000	922	First unit to be in service summer 1924.
City of Eugene (Ore.)	McKenzie (new unit)	McKenzie River, Ore.	1,500		50	To be in service early in 1924.
The California Oregon Power Company	East Side	Link River, Klamath Falls, Ore.	3,200	3,600	47	Work recently started. Finish by July, 1924.
Pacific Gas & Electric Company	Pit No. 3	Pit River, Calif.	81,000	81,000	313	Estimated completion date Oct. 1, 1925.
Western States Gas & Electric Company	El Dorado	American River, near Placerville, Calif.	20,000	60,000	1,900	In service January, 1924.
Great Western Power Company	Caribou (third unit)	Feather River, Calif.	24,000	96,000	1,008	To be completed early in 1924.
Modesto-Turlock Irrigation District	Don Pedro	Tuolumne River, Calif.	15,000	35,000	130-260	Completed in 1923.
Yuba Development Company	Bullard's Bar	Yuba River, Calif.	7,500	15,000	175	Plant to be put in service summer of 1924.
City of San Francisco	Moccasin Creek	Near Jacksonville, Calif.	70,000	105,000	1,315	Fifty per cent complete. Scheduled for service late in 1924.
Merced Irrigation District	Exchequer	Merced River, 35 mi. east of Merced, Calif.	25,000		300 (max.)	Preliminary work done. Construction may start any time.
San Joaquin Light & Power Corp.	Power House No. 3	North Fork San Joaquin River, Calif.	1,800	4,200	400	Plant capacity increased from 2,400 kw. to 4,200 kw. in 1923.
San Joaquin Light & Power Corp.	Balch	Kings River, Calif.	31,000	115,000	2,495	Roads, camp and transmission line built. Scheduled for service in 1926.
Southern California Edison Company	Big Creek No. 1 (third unit)	Big Creek, near Cascada, Calif.	16,000	73,000	2,131	Third unit put in service July, 1923.
Southern California Edison Company	Big Creek No. 1 (fourth unit)	Big Creek, near Cascada, Calif.	25,000	73,000	2,131	Work to be started early in 1924.
Southern California Edison Company	Big Creek No. 3	On San Joaquin River, in California, near junction with Big Creek	75,000	150,000	830	Completed October, 1923.
Southern California Edison Company	Big Creek No. 2 (fourth unit)	Big Creek below Plant No. 1	16,000	64,000	1,858	Work to be started early in 1924.
San Gorgonio Power Company	No. 1	San Gorgonio River, Calif.	1,650	1,650	1,789	Completed December, 1923.
San Gorgonio Power Company	No. 2	San Gorgonio River, Calif., below Plant No. 1	775	775	913	Completed January, 1924.
Southern Sierras Power Company	Leevining Creek No. 3	Leevining Creek, Mono County, Calif.	2,500	2,500	384	Completed December, 1923.
Southern Sierras Power Company	Leevining Creek No. 1	Leevining Creek, Mono County, Calif.	12,500	12,500	1,682	Forty per cent completed.
Southern Sierras Power Company	Owens River	Owens River Gorge, Mono County, Calif.	7,500	7,500	240	Active construction just begun. Five per cent completed.
Southern Sierras Power Company	Forest Home	Mill Creek, near Redlands, Calif.	2,250			Construction under way. To be completed in 1925.
Southern Sierras Power Company	Rush Creek No. 3	Mono County, Calif.				Construction work recently started.
Salt River Valley Water Users Association	Roosevelt Power Plant	Roosevelt Dam, Ariz.	7,500	16,000	100 to 240	Twenty-five per cent completed. To be in service in 1924.

Western Transmission Lines Completed in 1923 and Projected for 1924

Name of Company	Voltage in Kv.	No. Circuits	Supporting Structure	Length in Miles	Location	Present Stage of Construction
Montana Power Company	50	1	Single pole	26.7	Mystic Lake to Red Lodge, Mont.	Completed 1923.
Montana Power Company	50	1	Single pole	26.9	Sheridan to Dillon, Mont.	Completed 1923.
Montana Power Company	50	1	Single pole	22	Havre to Chinook, Mont.	Projected for 1924.
Washington Water Power Company	60	1	Single pole	50	Coulee City to Chelan, Wash.	Completed 1923.
Washington Water Power Company	110	1	Three pole	6	Mullan Junction to Burke, Idaho	Completed 1924.
Idaho Power Company	132		Wood pole	29	Caldwell to Ontario, Idaho	Completed June, 1923
Puget Sound Power & Light Company	110	1	Steel and wood pole	121	Dieringer to Wenatchee, Wash.	Completed 1923.
British Columbia Electric Railway Company	34.6	1	Wood pole	28	Vancouver to Brittania Beach, B. C.	Completed 1923.
City of Seattle	165	1	Twin wood pole	105	Skagit plant to Seattle, Wash.	To be completed 1924.
Pacific Power & Light Company	66	1	Wood pole	62	Pasco, Wash. to Pendleton, Ore.	To be completed 1924.
Portland Railway, Light and Power Company	57	1	Wood pole	19	Bull Run Plant to Lents Substation, Ore.	Completed 1923.
Portland Railway, Light and Power Company	57	1	Steel tower	18	Oak Grove Plant to Cazadero, Ore.	To be completed 1924.
Northwestern Electric Company	66	1	Single wood pole	17.6	Camas to Vancouver, Wash.	Completed 1923.
Mountain States Power Company	66	1	Single wood pole	19.4	Albany to Independence, Ore.	Completed 1923.
The California Oregon Power Company	60	1	Single wood pole	20	Line extension north of Klamath Falls, Ore.	Completed 1923.
The California Oregon Power Company	60	1	Single wood pole	6	Dixonville to Roseburg, Ore.	Completed August, 1923.
Pacific Gas and Electric Company	220	2	Steel towers for each circuit	5	Pit 3 Plant to Pit 1 Line at Hayne's Meadows, Calif.	To be completed late in fall of 1924.
Pacific Gas and Electric Company	110	2	Steel tower	25	Cooley Landing to Martin Station, Calif.	75 per cent complete. In service early in 1924.
Pacific Gas and Electric Company	110	2	Steel tower	30	Lake Chabot to Oakland-Newark Line, (Calif.)	50 per cent complete. In service 1924.
Great Western Power Company	165	1	Steel tower	12	Valona Substation to Golden Gate Substation, (Calif.)	Completed 1923.
Truckee River Power Company	60	1	Wood pole	31	Washoe Plant in Nevada to Summit, Calif.	Completed 1923.
Western States Gas & Electric Company	66	1	Steel pole	9	El Dorado Plant to Camino Tap, (Calif.)	Completed 1923.
City of San Francisco	120 or 154	2	Steel tower	200 to 240	Moccasin Creek to San Francisco, Calif.	To be constructed in 1924.
San Joaquin Light & Power Corporation	110	2	Steel tower	22	Balch Plant to Piedra, Calif.	One circuit completed Nov. 15, 1923.
San Joaquin Light & Power Corporation	70	1	Wood and steel	77	Buttonwillow to Santa Maria, Calif.	Completed 1923.
San Joaquin Light & Power Corporation	70	1	Wood pole	13	Dairyland to LeGrande, Calif.	Completed Feb. 12, 1923.
Southern California Edison Company	220	2	Steel towers for each circuit	240	Big Creek to Eagle Rock, Calif.	Changed from 150 kv. to 220 kv. in 1923.
Southern California Edison Company	220	2	Steel towers for each circuit	30	Eagle Rock to Laguna Bell Substation, (Calif.)	Completed 1923.
Southern California Edison Company	220	1	Steel tower	270	Big Creek to Eagle Rock and Laguna Bell Substations, (Calif.)	To be started in 1924 for use in 1926. Third Big Creek circuit.
Southern Sierras Power Company	88	2	Wood pole	100	El Centro to Warner's Ranch, Calif.	To be completed in 1924.
San Diego Consolidated Gas & Electric Company	66	2	Wood pole	9	Del Mar to Escondido, Calif.	To be completed Spring, 1924.
San Diego Consolidated Gas & Electric Company	88	2	Wood pole	17	Escondido to Rincon, Calif.	To be completed Spring, 1924.
Utah Power & Light Company	44	1	Single wood pole	28	Springville to Helper, Utah	Completed 1923.
Utah Power & Light Company	130	1	Twin wood pole	9.5	Grace Station to Soda Station, Idaho	Completed 1923.
Utah Power & Light Company	44	1	Single wood pole	56.5	Kenilworth to Sunnyside and Columbia, Utah	Completed 1923.
Public Service Company of Colorado.	90		Steel tower	35	Boulder Canon to Denver, Colo.	To be built in 1924.

Physical Aspects of the Pacific Coast Interconnected System

A survey of the Pacific Coast Interconnected System shows that two small gaps, one in Oregon and the other in Washington, remain before complete tie-in of the lines serving California, Oregon, Washington and Montana can be effected. With these gaps closed a system that has no parallel in any part of the world would then exist.

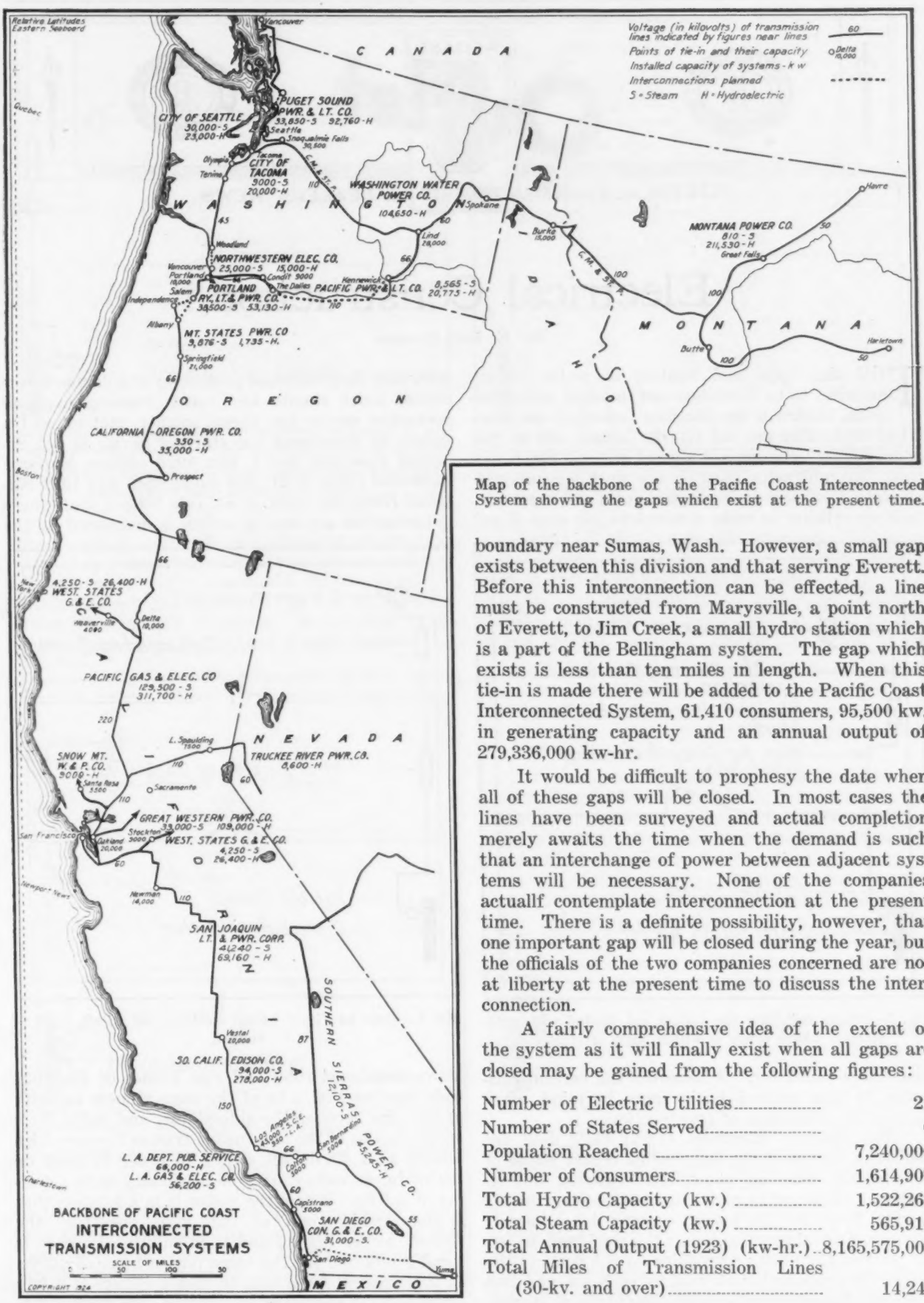
TWO important events influencing the development of an interconnected system serving the entire Pacific Coast occurred during the past year. One was the advent of 220,000-volt transmission on the lines of the Pacific Gas and Electric Company and the Southern California Edison Company, both of which are important links in the California interconnected system. The other was the closing of the gap at Wallace, Idaho, which existed between the lines of the Washington Water Power Company and the Montana Power Company, thereby throwing the resources of this latter company, which is one of the largest in the West, into the system which covers the Pacific Northwest.

Two hundred twenty thousand volt transmission has a particularly important bearing upon any discussion of interconnection for the exchange of large blocks of power. It is recognized by engineers that if power is to be transmitted economically over distances ranging between 250 and 500 miles this voltage is the minimum that can be employed. Consideration of the development of both the Colorado and Columbia Rivers, where the large blocks of power generated must be transported a considerable distance to markets, must include provision for 220,000-volt transmission.

A survey of the present interconnected system shows that there are two small gaps which must be closed before the lines covering California and southern Oregon can be joined with those covering Washington, Idaho and Montana. The construction of a 66,000-volt line from Albany to Independence, Ore., by the Mountain States Power Company, leaves a small gap of 18 miles between the latter point and Salem, which is served by the lines of the Portland Railway, Light & Power Company. It will be necessary to make this connection before the southern system can be linked with that serving the lower Columbia River region. Theoretically the gap is much smaller. The lines of the Oregon Electric Railway Company, which operate at 33 cycles and which are connected with those of the Portland Railway, Light & Power Company at Portland through frequency changers, parallel those of the Mountain States Power Company for a considerable distance south of Salem. Could this difference in frequency be overcome, interconnection would be simple. Again, the Southern Pacific Company, which operates an electric railway south of Portland, has a transmission line which originates at Salem, where energy is purchased from the Portland Railway, Light & Power Company, and extends through Independence, now served by the Mountain States Power Company. Theoretically interconnection could be effected at Independence. However, the requirements of electric interurban railway service are such that the commercial interchange of power over this line would not be practical.

Between the central stations serving the lower Columbia River territory and those comprising the Northwest interconnected system there are two possible courses of tie-in. Eastward along the Columbia River there is a long gap extending from The Dalles to Umatilla between the two systems of the Pacific Power & Light Company. This company proposes to close this gap at some date in the future. The most practical course is northward from Vancouver, Wash., along the line of the Northern Pacific Railroad. A small gap which previously existed south of Olympia between Tumwater and Tenino has been closed by the Puget Sound Power & Light Company, tying-in its North Coast Power properties with those forming a portion of the interconnected system covering Washington and Montana. The southern end of the North Coast properties is Kalama, a point on the Columbia River. South of Kalama there is a low-voltage line, the property of the Washington-Idaho Water, Light & Power Company, which extends to Woodland. The Northwestern Electric Company has an 11,000-volt line from Vancouver to Ridgefield, a small city five miles south of Woodland. Thus it is seen that the only physical gap between the Columbia River group of companies and the interconnected system is that between Woodland and Ridgefield, a distance of approximately five miles. Before the commercial interchange of power would be possible, however, it would be necessary to construct at least a 60,000-volt line from Vancouver to Kalama, a distance of about 30 miles. With this gap closed and an interconnection effected between Salem and Independence, Ore., the Pacific Coast interconnected system would then be complete.

Reference is often made to an interconnected system extending from the Canadian to the Mexican borders. Before such a system would be possible, a small gap must be closed between the Everett and Bellingham divisions of the Puget Sound Power & Light Company. The Bellingham division is interconnected with the lines of the British Columbia Electric Railway Company, Ltd., at the international



Map of the backbone of the Pacific Coast Interconnected System showing the gaps which exist at the present time.

boundary near Sumas, Wash. However, a small gap exists between this division and that serving Everett. Before this interconnection can be effected, a line must be constructed from Marysville, a point north of Everett, to Jim Creek, a small hydro station which is a part of the Bellingham system. The gap which exists is less than ten miles in length. When this tie-in is made there will be added to the Pacific Coast Interconnected System, 61,410 consumers, 95,500 kw. in generating capacity and an annual output of 279,336,000 kw-hr.

It would be difficult to prophesy the date when all of these gaps will be closed. In most cases the lines have been surveyed and actual completion merely awaits the time when the demand is such that an interchange of power between adjacent systems will be necessary. None of the companies actuallf contemplate interconnection at the present time. There is a definite possibility, however, that one important gap will be closed during the year, but the officials of the two companies concerned are not at liberty at the present time to discuss the interconnection.

A fairly comprehensive idea of the extent of the system as it will finally exist when all gaps are closed may be gained from the following figures:

Number of Electric Utilities	21
Number of States Served	6
Population Reached	7,240,000
Number of Consumers	1,614,907
Total Hydro Capacity (kw.)	1,522,265
Total Steam Capacity (kw.)	565,916
Total Annual Output (1923) (kw-hr.)	8,165,575,000
Total Miles of Transmission Lines (30-kv. and over)	14,247

The COAST Outlet
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Electrical Construction

By E. Earl Browne

THE size, type and location of motor circuit switches to be furnished and installed under the usual electrical specification furnished the electrical contractor are not clearly defined and as the usual "Joker" clauses are always present which say that "the contractor must do the work according to all state, local and underwriters' rules and must furnish everything to make a complete job even if not specifically called for," it behooves the careful estimator to keep several basic facts in mind when figuring on this class of construction.

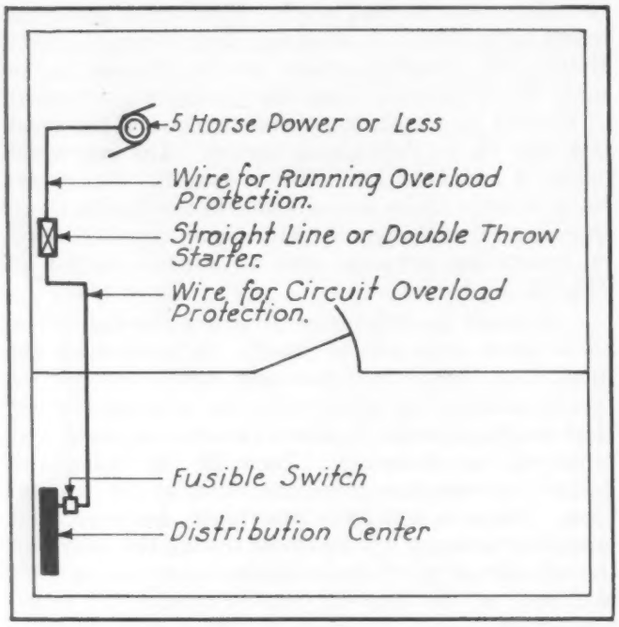

5 Horse Power or Less
Wire for Running Overload Protection.
Straight Line or Double Throw Starter.
Wire for Circuit Overload Protection.
Fusible Switch
Distribution Center

Fig. 1—Proper switching for motors not started with auto-starters where motor is within sight of starter.

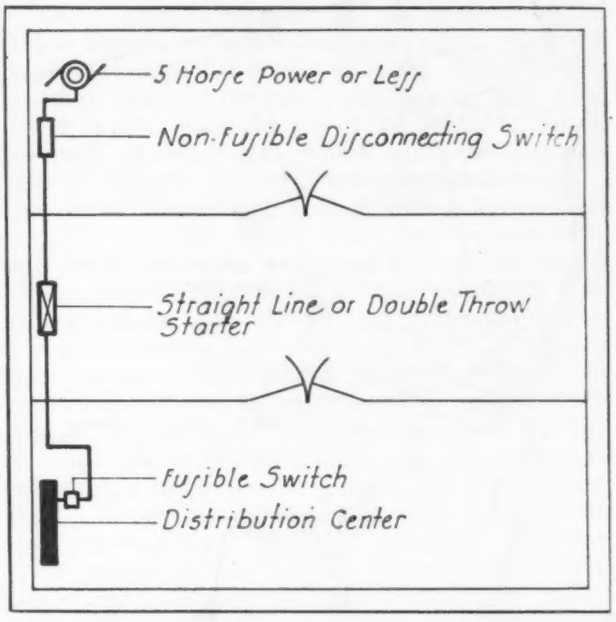


Fig. 2—Same as Fig. 1 except motor is not within sight of starter.

The National Electrical (Fire) Code does not demand a switch at the distribution center ahead of the "circuit overload protection" cutouts, but as nearly all state and municipal inspection departments demand these for life hazard reasons it has become almost universal practice to use the combined device. As most of the power companies do not demand the use of an auto-starter on motors of 5 hp. and less it is usual to provide a "straight line" type of starter with time limit overload protection or a double throw switch which shunts the motor running overload protective device for these smaller motors and a switch to disconnect the starting device is not required (See Fig. No. 1, also 1920 edition, National Electrical Code, p. 21, 2nd paragraph, and 1923 National Electrical Code, p. 84, rule 1003-i), but where auto-starters are used a switch is demanded by the above-mentioned rules and rule 1003-n of the 1923 code requires that it be of the same ampere capacity as the wire between the auto-starter and motor. This switch can be of the non-fusible type as it is provided merely as a disconnect switch in order to work on the motor or auto-starter or machinery with a feeling of safety. Where the motor is in a location that is not within sight of the man operating the starter, as per Figs. 2 and 4, an additional switch is usually required for the same reason as cited above, as it is natural for a man to take a chance if a trip downstairs is necessary to lock the auto-starter dis-

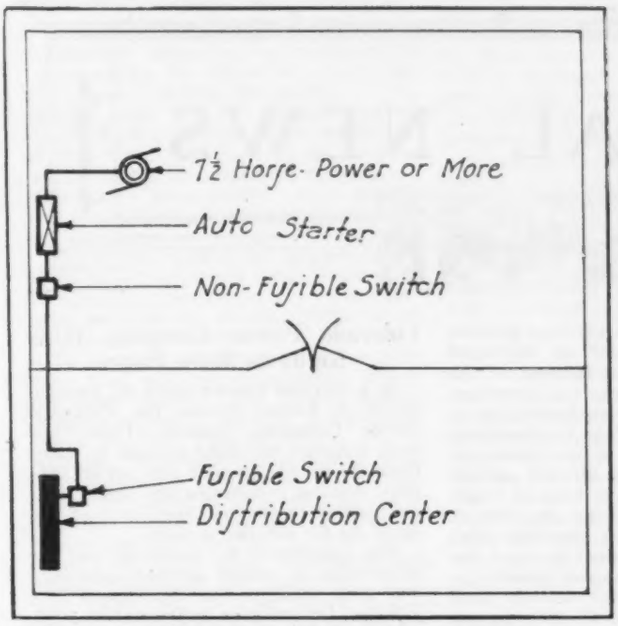


Fig. 3—Proper switching for motors started with auto-starter where motor is within sight of starter.

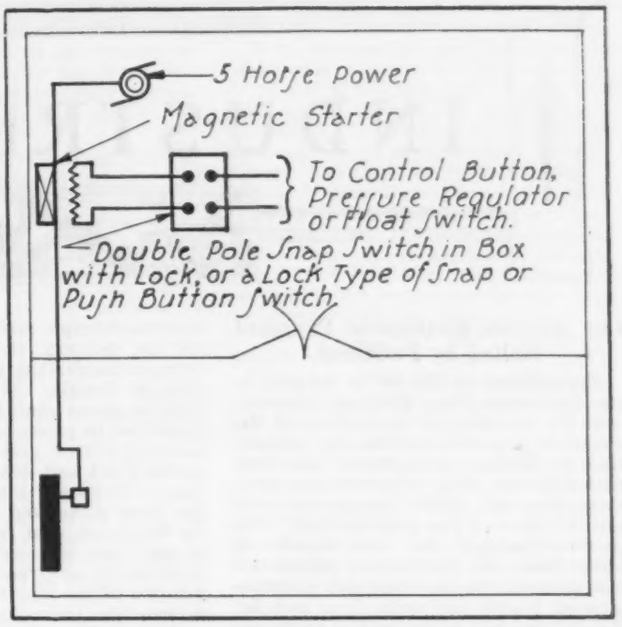

5 Horse Power
Magnetic Starter
To Control Button, Pressure Regulator or Float Switch.
Double Pole Snap Switch in Box with Lock, or a Lock Type of Snap or Push Button Switch

Fig. 5—Magnetic starter installation on small motors with locked push or snap switch in control lines.

connect switch open. Where magnetic starters are installed in connection with motors not requiring an auto-starter, either a disconnect switch should be installed ahead of the starter (Fig. No. 6) or a push button or snap lock switch can be installed in the control lines (Fig. No. 5) and if the motor be not

Nearly all elevator machinery companies desire to do all work in plant house or elevator machinery room in connection with their controllers and motors. It is, however, necessary that a disconnect switch be installed near the machinery and this must be furnished by the electrical contractor. This is an

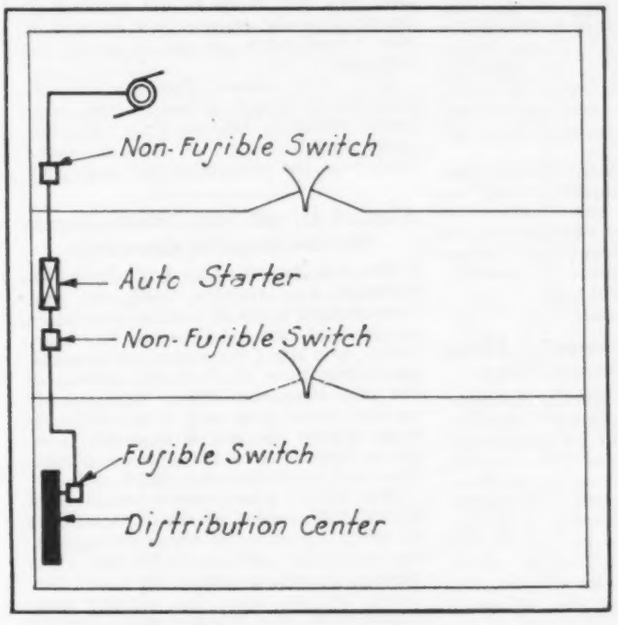


Fig. 4—Same as Fig. 3 except motor is not within sight of starter.

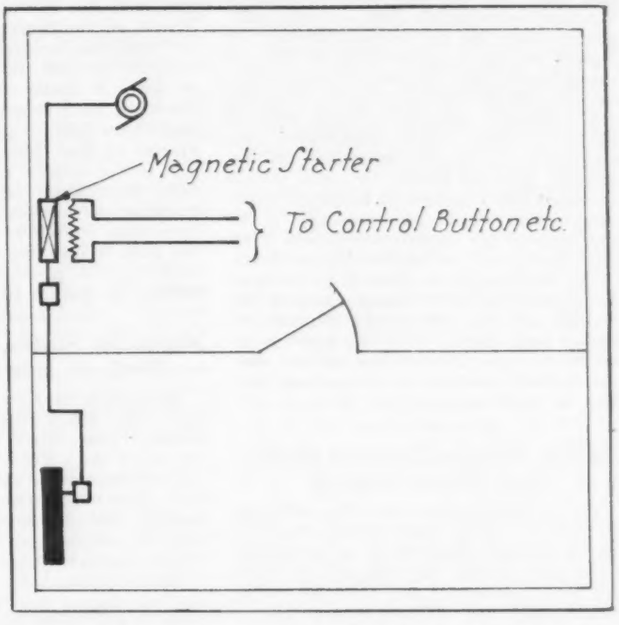


Fig. 6—Same as Fig. 5 except safety switch is installed ahead of starter instead of a switch to disconnect control lines.

within sight of the starter, as for instance a deep-well pump with float switch control on roof and magnetic starter in engine room, then an additional disconnect switch should be installed at motor as per Fig. No. 4.

arbitrary understanding as, of course, there must be a well defined line drawn between the end of the electrical contractor's work and the beginning of the elevator contractor's installation. An arrangement can be made to suit both contractors.

INDUSTRIAL NEWS

Los Angeles Evaluation Payment Halted by Petitions

Expenditure of $50,000 to be paid to the California State Railroad Commission for securing an evaluation of the electrical properties of the Los Angeles Gas & Electric Corporation has been halted by the filing of referendum petitions, bearing 58,766 signatures, with the city clerk of Los Angeles, Calif. The petitions compel the city council to either place the resolutions, calling for the payment to the Railroad Commission of $5,000 for work done and for $45,000 for future evaluation work, before the voters for their sanction or the repeal of the measures.

Some weeks ago the same alternative was placed before the council when a sufficient number of signatures was secured to halt the city from paying the Railroad Commission $25,000 as part payment for the evaluation work. At that time the council repealed the $25,000 measure and passed the two resolutions calling for the expenditure of $50,000.

The last petitions were filed with the city clerk by the Los Angeles Gas & Electric Corporation. That concern suggested that the number of voters who signed the petitions be checked only to the amount that it would be necessary to have the matter come up at the general election. As only 10 per cent of the registered voters' signatures are necessary to get the measures on the general election ballot, the city would be saved the expense of a special election, which would be necessary if 15 per cent of the registered voters were ascertained to have signed the petitions.

The two measures passed by the Los Angeles council were inaugurated at the request of the Municipal Bureau of Power and Light. The purpose is to secure an evaluation of the private corporation's properties in order that they may be condemned by the city.

Seattle Electro-Chemical Power Rate Before Council

Twenty-five dollars per kilowatt year is the rate fixed for electro-chemical power, by the provisions of an ordinance introduced in the city council at Seattle, Wash., recently and referred to the finance and city utilities committees.

By the terms of the bill "electro-chemical power" is held and construed to mean power used solely for the purpose of manufacturing chemical products by users whose minimum load is 1,000 hp. or more. The bill further provides that the superintendent of lighting be authorized to contract with users of electro-chemical power for the furnishing thereof for any period not exceeding 25 years, in such amount and upon such terms and conditions governing the delivery thereof as he shall deem to be for the best interest of the City of Seattle. There is a provision that no power shall be contracted to be furnished in excess of the hydroelectric capacity of the units of the municipal power plant and system already operating, or those the construction of which has been authorized by the city council. In the event that such capacity shall at any time be insufficient to meet the demand for electro-chemical power, the priority of the date of the contract shall govern the furnishing of such power, and the same shall not be prorated among all applicants.

This is the second change in power rates within a month, the council passing a bill two weeks ago, fixing the rate for what is known as "waste power" at one mill per kilowatt-hour. Both changes are in the interest of industrial development.

One-Third of Normal Snowfall Now on Sierra Nevadas

Approximately one-third of the normal snowfall for this time of the year is now on the Sierra Nevada Mountains in California, according to United States weather bureau reports. At Summit, on Jan. 28 there were 33 in. of snow. Snowfall gage records show that in normal years 100 in. of snow were on the ground at that time.

It is the opinion of many power company men that the condition may be regarded as serious. The problem is somewhat simplified by the fact that in the past it has been found that 50 per cent of the precipitation is recorded during the month of February.

Mountain States Company Plans Work on New Power Plant

According to A. L. Martin, manager of the Mountain States Power Company, Albany, Ore., work will be commenced not later than Feb. 15 on the proposed new steam power plant at North Bend, Ore. The plant, which will cost approximately $600,000 and develop 6,700 hp., will be erected in the center of the Stout Lumber Company's mills.

Refuse from both mills will be used as fuel and oil stored at the company's nearby gas plant can also be drawn upon in emergency. In addition, the company plans to build two large scows on which fuel can be carried from adjacent mills on Coos Bay.

The California-Oregon Power Company has applied to the Public Service Commission of Oregon for permission to raise its light and power rates, effective as of Feb. 1.

Colorado Power Company Wins Right to Raise Rates

In a decision handed down by Federal Judge J. Foster Symes the Colorado Power Company, Denver, Colo., has been accorded the right to raise its rates from 20 to 40 per cent for power supplied mining companies and small municipalities in the northern part of the state on its central system.

The application for increases and for permission to cancel certain contracts was first made to the Colorado Public Utilities Commission in December, 1919, and finally denied in April, 1923. The judge ruled that the rates to which the commission sought to hold the company were confiscatory on the valuation of its holdings on its central system, as arrived at in the federal court, and placed the present valuation at $9,613,325.94, as against the $4,211,460 set by the commission. The company claimed a valuation of over $11,000,000. Judge Symes held that under the commission's rates the power company was denied a fair return on its investment, and that during the four years since the application was first made it had suffered an irreparable and confiscatory damage by the commission's refusal to grant the increase.

The court ordered that the company continue to supply power to consumers under contract, holding that the company was to blame if it was losing money at the stipulated contract rates.

First Unit of New Plant Begun by Los Angeles Company

The Los Angeles Gas & Electric Corporation, Los Angeles, Calif., has purchased eight acres of land at Seal Beach on the east side of Alamitos Bay inlet, Calif., as a site for a steam power plant. According to A. B. Day, superintendent for the company, work has already started on the first unit, which will generate 44,000 hp. and is expected to be put in operation in the summer of 1925. The cost is estimated at $3,500,000.

The entire plant, which when completed will consist of six units, will be of steel and concrete construction, costing ultimately about $15,000,000. The generators will be driven by steam turbines, and an order has already been placed with the Westinghouse Electric & Manufacturing Company for the first generator, which it is said will be the largest in operation west of Chicago. Natural gas and oil will be used as fuel. The proposed use of water from the ocean for cooling purposes was one of the main considerations that led to the selection of the site purchased.

The power generated will be transmitted 25 mi. direct to Los Angeles over 110-kv. transmission lines.

Nineteen Permits Are Issued by California Water Board

Nineteen permits to appropriate water within the State of California were issued during the month of December, 1923, by the Department of Public Works, Division of Water Rights of that state. Only one of the permits issued covers hydroelectric projects of appreciable importance. This permit was issued to the Pacific Gas and Electric Company.

The permit grants the appropriation of 50 sec.-ft. of water from North Battle Creek in Tehama County. The company proposes to develop 2,722 hp. at an expense of $25,400.

Thirty-seven applications for permits were filed with the department during the same month. The largest hydroelectric project is covered in an application filed by Fred P. Tuttle, Jr., of Auburn. The application states that the proposal is to develop 107,000 hp. at power houses to be erected in Placer and El Dorado Counties. Permission to appropriate 1,200 sec.-ft. and 200,000 acre-ft. of water from the North and Middle Forks of the American River and from the Rubicon River is requested. The estimated cost of the development is $18,654,000.

The City of Los Angeles and the Board of Public Service Commissioners of that city have applied for two permits to appropriate water. The first application covers a project in Mono County where by using 56 sec.-ft. and 9,000 acre-ft. of water from Rock Creek and 14 sec.-ft. and 5,500 acre-ft. from the East Fork of Rock Creek, it is proposed to develop 12,300 hp. The estimated cost of this project is $1,705,350. The second application proposed the appropriation of 20 sec.-ft. and 18,966 acre-ft. of water from Baker Creek and Sanger Meadows Fork of Baker Creek in Inyo County to develop 9,646 hp. This project would be used in connection with the Big Pine Creek project of the city. It is proposed to construct 4.9 miles of concrete lined ditches and tunnels. The estimated cost of the development is placed at $750,000.

Largest Budget Since 1913 Made by British Columbia Utility

The British Columbia Electric Railway Company is planning an expenditure during 1924 of $5,250,000, on additional power plants and equipment around Vancouver, B. C.

At the Stave Falls plant there will be installed a fifth generator and the four existing generators will be rewound and the turbines readjusted to increase the output of power, taking advantage of the increased head of water since the dam was raised. The output of power from this plant will be increased from 36,000 kw. to 54,000 kw. at a cost of $1,000,000. It is expected this work will be completed by November, 1924.

On the Alouette Lake project adjacent to Stave Lake, $760,000 will be spent in 1924, and a further $1,385,000 to complete this development in 1925. The power plant which will be situated at the mouth of the tunnel between Alouette Lake and Stave Lake will generate 9,000 kw.

An additional high tension line will be built between Stave Falls and Vancouver and the present high tension lines will be increased in size so that the capacity of the lines will be trebled. Two of the high tension lines between the Lake Buntzen plants and Vancouver will be increased in size and wood pole lines partly replaced by steel towers. The total cost of these high tension improvements is $563,000.

Additional substation and transformer equipment in and around Vancouver will call for an expenditure of $421,000. An automatic substation in Vancouver is among the items proposed.

Additional high tension switches and gear for power plants and substations will cost $265,000 and the finishing of the work on the Blind Slough dam will represent $90,000.

A 12,000-volt power line, mostly underground, will be built to encircle the industrial section of Vancouver from Horne Payne receiving station to Haro Street substation, via the waterfront and back to Main Street substation via False Creek. This will feed the elevators, docks and mills direct from the receiving station and thus relieve the city substation. At the same time a start will be made on placing the power lines in the down town section underground. The scheme will ultimately cost $500,000. The expenditure on these matters this year will be $304,000.

On Vancouver Island the company is planning new high tension lines between its Jordan River plant and Victoria. On the company's railway system there will be spent $600,000 on track work and rolling stock.

This is the largest budget of expenditures the company has made since 1913. George Kidd, president of the company, intimated recently that arrangements were in progress to issue approximately $4,000,000 in additional securities in London. Mr. Kidd left the beginning of February for England to discuss matters with the directors of the company.

Seattle Municipal Railways Placed on Warrant Basis

Commencing Jan. 10, the municipal railway system of Seattle was placed on a warrant basis for four months in order to divert daily receipts to the bond redemption and interest fund account to take care of annual redemption payments falling due March 1. At that time, according to a statement of the city treasurer, there will be a deficit in that fund of $400,000, due to loans made to the operating fund last spring and summer to cover losses sustained by the system when the five-cent fare was in effect.

Plans have been made to retire warrants to the amount of more than $375,000 monthly so that each bi-monthly issue will be retired before the end of the four-month period.

R. H. Ballard, vice-president and general manager of the Southern California Edison Company, Los Angeles, Calif., at a recent meeting of the City Club of Los Angeles, declared emphatically that there was no shortage of hydroelectric power imminent in Southern California, and stated that plans of his company call for the development of power sufficient to serve 6,000,000 consumers instead of the 2,000,000 now served.

Outline Construction Program for San Diego Utility

New construction and improvements contemplated by the San Diego Consolidated Gas & Electric Company for 1924 call for a budget of approximately $2,600,000, according to statements made by company officials recently. Though less than the 1923 expenditures by nearly a million dollars, it is pointed out that many improvements were made to that company's system last year that will not have to be duplicated for some time. Sufficient generating capacity and substation improvements were made to take care of San Diego's growth for another year, it is felt by the company's officials.

Of the 1924 improvements, aside from numerous gas plant enlargements, the major electric activity of the San Diego Consolidated Gas & Electric Company will be in connection with the Southern Sierras Power Company tie-line to Imperial Valley. It is estimated that $200,000 will be spent by the San Diego company to build a substation at Escondido to care for this tie-line and to build a line from the Escondido substation to Rincon to connect with the Southern Sierra Power Company's lines.

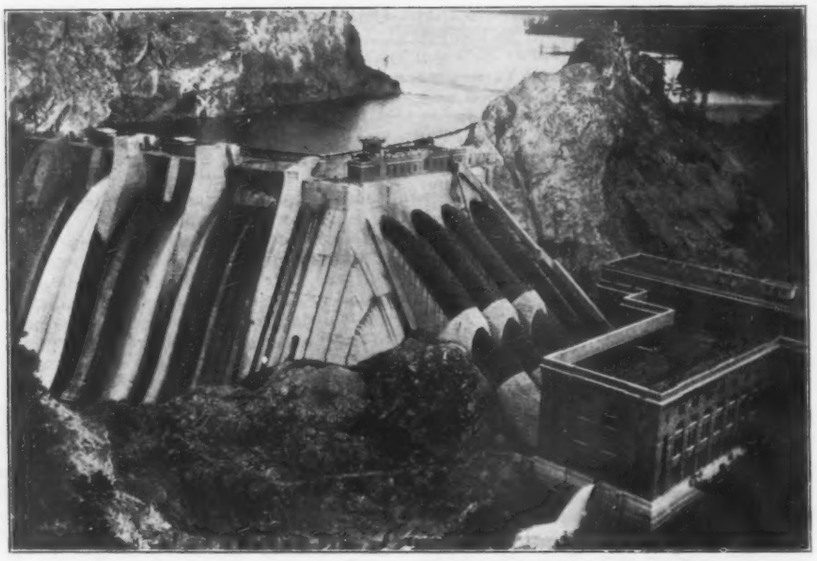
In electric production the San Diego Consolidated Gas & Electric Company will make only minor changes, since last year saw the completion of the installation of a 15,000-kw. unit and five B. and W. boilers. A 5,000-kw. turbo-generator will be moved to a new location in that company's Station B to allow for future installation of another 15,000-kw. unit when needed. All direct current generators formerly driven by steam turbines in this same station will be given motor drive and several improvements to pumping and auxiliary apparatus will be made.

Station C, the show place of the company's system, a semi-residential district substation of artistic architectural design, will receive few changes, but it is contemplated that plans for a future "Station D" to serve further residential territories north and east of the park in San Diego will be prepared during the year.

The electric repair shop, under process of construction, will be finished and put into use within the next few months, it is planned. Equipped with all test facilities, transformer platforms and latest equipment, this shop is to be one of the most modern on the coast.

The San Diego Consolidated Gas & Electric Company also expects to move its commercial offices into the building acquired by it last year and renamed the "Electric Building." Commercial offices are now being prepared on the ground floor, and it is declared by officials of the company that they will compare with any bank of the city for appointments and equipment. Pneumatic tubes, telephone and dictaphone connections to the other offices of the company on the second, third and eighth floors of the building will be the latest in design and efficiency. High speed elevators are also being installed to replace those formerly in the building.

Citizens of Pasadena, Calif., on Jan. 10, 1924, approved the issuance of bonds to the extent of $250,000 for light and power extensions.



Long Lake Power House of the Washington Water Power Company in which a fourth unit is added. The new penstock is at the extreme right.

Work on Long Lake Plant Fourth Unit Nearly Completed

Construction work on the fourth unit of the Long Lake plant of the Washington Water Power Company is rapidly nearing completion. The unit that is being installed is rated at 23,500 hp. and will bring the total capacity of the plant up to 94,000 hp. The total cost of the Long Lake plant, which is located on a narrow gorge on the Spokane River, will be brought to about $6,000,000 by the installation that is nearing completion.

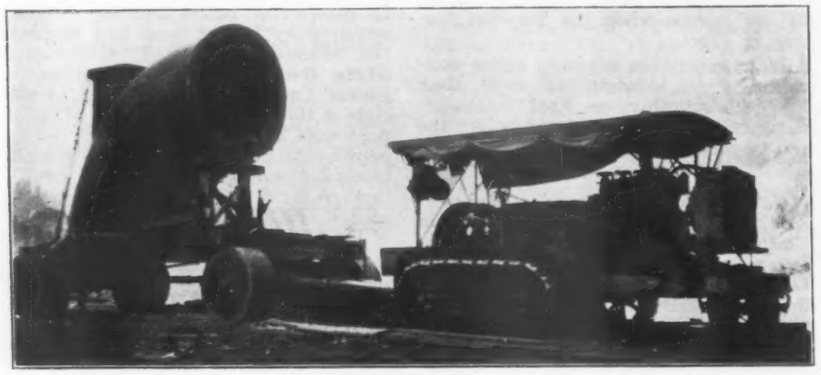
Considerable difficulty was met by the engineers of the Washington Water Power Company in getting materials and equipment to the power house. The plant is located seven miles from the nearest railroad and all material had to be hauled over an abandoned railroad grade. The equipment that has been installed in the plant was delivered at Ford, Wash., and from that point was hauled by a tractor attached to a specially constructed trailer.

Deliveries of the generator equipment and water wheel parts began early last November and it was necessary for the tractor to make 16 trips during that month to haul the heavy parts to the power plant. The total weight of the water wheel parts was 117 tons, of which the shaft and two runners amounted to 37 tons. This was the heaviest load hauled by the tractor, the total weight being 50 tons as the trailer itself weighed 13 tons. The generator parts weighed 222 tons. The lower half of the stator frame weighing 33¼ tons was the heaviest single load hauled while the generator parts were being transported. It took the tractor an entire day to make the seven-mile trip when the heavier loads were hauled.

Power Company Plans Expansion of Elwha River Plant

The Northwestern Power and Manufacturing Company, a corporation of Wilmington, Del., has applied for the right to divert 1,300 sec.-ft. of water from the Elwha River, near Port Angeles, Clallam County, Wash. The water will be used to supply another unit which the company plans to add to its hydroelectric plant already in operation on the Elwha River.

The company proposes the construction of a reinforced concrete dam, 15 ft. high and 180 ft. long, to impound the water, and a canal 3½ mi. long to carry it to a power plant for the additional development of 20,000 hp. Work would be commenced about Jan. 1, 1925. The cost is estimated at $1,600,000.



Part of the water wheel assembly being transported from Ford to the power house. The heaviest load totaled 50 tons

Electrical Exhibit Entered in Denver Women's Pageant

One of the features of the recent pageant ball of the Denver (Colo.) Women's Press Club is said to have been the spectacular display of the Electrical Cooperative League of that city.

Preceding the ball a costume pageant and parade was participated in by over a thousand people representing various organizations, characters, and periods of American history. Electricity came in for its share of honor, according to reports, through the league display of a small self-propelled electric truck on which was enthroned the electrical queen, portrayed by Miss Janette Edwards.

The color scheme was entirely in black and white with small 2-cp. lamps embedded in the decorations. Over 400 lights were required on the truck and Miss Edwards' costume. A large sign with the name of the organization was placed on each side of the truck.

Members of the Denver league advisory board who arranged the novel display were Harry D. Randall, R. G. Gentry and Dean D. Clark. According to reports, a considerable amount of effective publicity was secured for the electrical industry, both at the pageant and in the Denver newspapers.

Baker River Site Applied For by Puget Sound Company

The Puget Sound Power & Light Company of Seattle, Wash., has applied for permission to divert 4,000 cu. ft. of water from the Baker River, a tributary of the Skagit River, in order to construct a hydroelectric power plant and reservoir, to be known as the Baker River Water Power Development, Eden Site.

Stone and Webster, Inc., will have charge of the engineering work which will be begun Sept. 30, 1924, if the permit is granted, and will be completed in two years. The plant will cost approximately $3,500,000 and will be designed to develop 65,000 hp.

Hetch Hetchy Water Issue Voted Paramount to Power

The Down Town Association of San Francisco, Calif., recently adopted the following resolution relative to that city's municipal water and power project: "Resolved, That the Down Town Association is in favor of completing the bringing of water from Hetch Hetchy to San Francisco, and that the bringing of water is paramount to the distribution of power in San Francisco."

The association also expressed its full confidence in the present Board of Supervisors, "their integrity, honesty of purpose and their desire to serve the best interest of the whole people of San Francisco."

A test of the Lake Cushman power project dam was recently made by means of a model dam and an apparatus for applying hydraulic pressure to it. The results as announced by Ira S. Davidson, commissioner of the Tacoma, Wash., municipal light and power department, show that the dam as designed will be at least twenty times as strong as necessary to withstand the pressure of the impounded water.

San Francisco Supervisors Vote to Start Evaluation

Proceedings to submit two large Hetch Hetchy bond issues to the people of San Francisco, Calif., were started at the meeting of the Board of Supervisors of that city on Jan. 21. At the same time the supervisors passed a resolution calling on the California State Railroad Commission to make an evaluation of the San Francisco electrical distributing systems of the Pacific Gas and Electric Company and the Great Western Power Company.

The action taken by the supervisors recalls the eight weeks' postponement of the request for an evaluation that was passed at a meeting two weeks previous. As a result of the most recent action, the Railroad Commission will be called upon immediately to make a survey of the value of the two distributing systems. The valuation will be fixed for condemnation purposes.

The two bond issues tentatively call for a total issue of $39,000,000. Twenty-four million dollars of this, according to present plans, will be used in completing the 48 miles of tunnel necessary to bring the Hetch Hetchy water supply to San Francisco. The other issue, for $15,000,000, is planned to be used in building or purchasing an electrical distribution system in the city. The date of the bond issue is to be announced within three weeks.

Robert Searls, special counsel, has recently announced that it is his opinion that money from the original Hetch Hetchy bond issue cannot be used for paying the costs of evaluating the two San Francisco distributing systems. This issue was voted by the people of San Francisco in 1910 and was for the city's water system and power necessary to pump the water over the mountains. Mr. Searls pointed out that the supervisors might appropriate the necessary funds from the city's general fund.

Index to Volume 51 Ready for Distribution

The index to Volume 51, pages 1-472, of the Journal of Electricity has been compiled and is now ready for distribution. The index contains a completed listing of all items appearing in the magazine from July 1, 1923, to Dec. 15, 1923, inclusive.

Copies of the index will be supplied without cost to subscribers upon application. Those desiring to secure copies of the index should address the Circulation Manager of the Journal of Electricity, 883 Mission Street, San Francisco, Calif.

San Diego Club Asked to Attend Los Angeles Banquet

Announcement that the Electric Club of San Diego, Calif., had been invited to attend the annual banquet and dance to be held by the Los Angeles Electric Club at the Biltmore Hotel on Feb. 2 was made at the Jan. 15 meeting of that organization. Invited as the special guests of the Los Angeles organization, which visited the San Diego club last summer, practically all of the San Diego club members who can get away are planning to make the trip north.

S. F. Forbes, Pacific Coast manager of the Fairbanks-Morse Company, gave the San Diego Electric Club an historical survey of the electrical development and possibilities of the western states, at the same meeting. Reviewing the three epochs of the West, the discoveries, the coming of first civilization, and the third and greatest epoch, that of electrical development, Mr. Forbes predicted untold possibilities for growth.

A number of guests attended this meeting of the club, one of the largest in attendance in club affairs. H. G. Folsum, of the J. A. Roebling's Sons Company, Los Angeles office, Stanley Forbes, Los Angeles manager of the Fairbanks-Morse Company, Lieutenant Friedman of the Naval Air Station, Paul D. House, Electric Products Corporation, Los Angeles, Fred Fermin, Mission Beach Company, and Miss Frances Sherman, who urged support of high school auditorium bonds, were among those present at the meeting.

Christmas Parties Are Held for Puget Sound Employees

Two Christmas parties of large size were held during the last holiday season for the employees of the Puget Sound Power & Light Company. The first of these was held in Seattle, Wash., Dec. 18, when approximately seven hundred children were entertained.

At this meeting, which was attended by the southern district employees and their children, A. W. Leonard, president of the company, and Mrs. Norwood W. Brockett, wife of the vice-president and general manager, acted as Santa Claus and Mrs. Santa Claus, much to the delight of the guests at the party. Presents were given to each child that attended the party.

A. W. Leonard and Mrs. Norwood W. Brockett impersonating Mr. and Mrs. Santa Claus.

The second Christmas gathering was held at Bellingham on Dec. 22. Mr. Leonard also appeared as Santa Claus at that time and from the base of a large Christmas tree passed presents to the three hundred children assembled for the occasion. Nearly all of the employees of the northern division of the company were present at the party.

Washington Water Power Co. Plans Improvements

According to plans outlined, the Washington Water Power Company, Spokane, Wash., contemplates making improvements during 1924 to the extent of about $2,000,000. Included in the major items is the construction of a new 110,000-volt transmission line to the west from the Long Lake power station, joining the existing western lines at Stratford. Upon completion of this line, the line running north and south from Coulee City and Stratford to Neppel, which was originally built for ultimate use at 110,000 volts but for temporary use at 60,000 volts, will be changed to its maximum capacity.

The company also plans the construction of a line from Neppel to Taunton, connecting there with the high tension intermountain line to the west, which now serves the Chicago, Milwaukee & St. Paul Railway. This will furnish duplicate high tension service to the substations supplying power to Creston, Wilbur, Almira, Hartline, Coulee City, Stratford, Neppel, Ephrata and Quincy.

Another new line running south from a point east of Spokane into the Palouse country to reinforce the existing lines in that territory is also contemplated. An additional transmission line from Long Lake to Spokane is under consideration, which would make the fourth high tension circuit there. The plans also comprise bringing the excess power from the Similkameen plant, near Oroville, Wash., upon its completion, into the general distribution system of the company, either by reinforcing the present line through the Okanogan Valley or constructing an additional line.

The Washington Water Power Company, of Spokane, Wash., has completed the installation of a 2,150 hp. water wheel at the Similkameen Power House at Oroville. James McNair of the engineering department has supervised the construction work. In order to make final tests, the following men left Spokane for Oroville on Jan. 16: R. L. Hearn, assistant chief engineer, Eugene Logan, civil engineer, John A. Tobyn, operating engineer, all of The Washington Water Power Company, and Major B. L. Eaton, erecting engineer for Wm. Cramp & Sons Ship & Engine Building Corporation. The water wheel was made by the Pelton Water Wheel division of Wm. Cramp & Sons, and the generator by the General Electric Company. A test made on Jan. 18 was entirely satisfactory.

Officers for the year 1924 have been elected by the Electrical Contractors' and Dealers' Association of San Francisco. Edward Martin, of the Sterling Electric Company, is the new president; George Smith, of Smith Electric Company, is vice-president, and E. Earle Browne, of Browne-Langlais Electrical Construction Company, is recording secretary. The new executive committee is composed of Walter R. Mobley of the American Electrical Engineering Company and Victor Lemoge, retiring president. Felix Butte, of the Butte Electric Equipment Company, is Central Council representative, with T. De Pass serving as alternate.

Sacramento Valley Association Meets at Substation

The Sacramento Valley Electrical Society met at 6:30 on Jan. 9, at the Vaca-Dixon substation of the Pacific Gas and Electric Company, located between Dixon and Vacaville, Calif., on the Sacramento-Oakland highway. President H. E. Willis presided. This meeting was the first ladies' night ever held by the society and 250 persons were in attendance. The ladies of the Dixon Community Council prepared the dinner. Music during the evening was furnished by the Pacific Gas and Electric Company orchestra.

Don C. Ray, manager of the bureau of public relations of the Pacific Gas and Electric Company and acting as the personal representative of R. E. Fisher, vice-president in charge of public relations and sales, gave an address of welcome to those present. Captain C. S. Nussbaum, secretary of the Dixon Chamber of Commerce, spoke for that organization and its work in the community. R. A. Balzari, chairman of the "Smiles" committee of the Pacific Coast Electrical Association, spoke on the Courteous Service Club drive to be carried on within the entire electrical industry. In order to create enthusiasm within the Sacramento Valley Electrical Society during the campaign, R. T. Stephens and Roy N. Phelan were appointed captains of competitive teams to secure members. M. J. Mulholland sang two solos and also led the group singing.

A number of slides and a reel of moving pictures of the Pit River development of the Pacific Gas and Electric Company were shown, and Mr. Mulholland told of this development work. An opportunity was afforded everyone to inspect the substation. Following this inspection trip a classical dance was given by four girls from the Dixon Union High School and the remainder of the evening was devoted to dancing.

Third Annual Radio Exposition to Be Held Feb. 6-10

The third annual radio exposition will be held in Los Angeles, Calif., Feb. 6-10, at the Biltmore Hotel. It will be conducted by the American Radio Exposition Company of New York, which was formed several years ago for the purpose of holding annual radio expositions in different parts of the country.

A wide assortment of equipment will be exhibited. The Los Angeles Chamber of Commerce and the Southern California Radio Association are cooperating to make the event a success. Arrangements are in charge of J. C. Johnson, local representative of the exposition company, with offices at Room 707 Bank of Italy Building, Los Angeles.

Washington Sales Department Is Entertained at Banquet

At a banquet held at the Davenport Hotel, Spokane, Wash., recently, the Washington Water Power Company of Spokane entertained its sales department, in appreciation of the records made this year in the sales of electrical merchandise. As compared with 1922, sales for 1923 were nearly doubled.

Lewis A. Lewis, sales manager, presided and gave a short review of the work done during the past year, his talk being followed with a statement of the plans for the coming year, outlined by his assistant, R. B. McElroy. J. E. E. Royer, assistant to the general manager, expressed the interest taken by the management in electrical merchandise as a revenue builder, and described the plans for betterments to be executed during 1924. J. F. Farquhar, in charge of district sales, told of the sales results obtained in the territory served by the company.

The banquet was attended by 30 guests, representing the sales department of Spokane, the only out-of-town member being H. I. Klehm, district agent of Ephrata.

The Pacific Coast broadcasting station of the General Electric Company, located at Oakland, Calif., was opened to the public for inspection on Jan. 21. The station was visited by a large number of invited guests between the hours of 10 a.m. and 10 p.m. on that day. The new broadcasting station, known as KGO, is sending out radio programs on Tuesday, Thursday and Saturday nights of each week.

"The Illuminator," an illustrated magazine of eight pages, made its first appearance in January. This is the new company publication of The Washington Water Power Company, Spokane, and while every employee is invited to contribute, the Department of Public Relations will act as managing editors. The magazine will be sent free to each full time employee of the company.

The El Dorado hydroelectric plant of the Western States Gas & Electric Company on the American River, Placer County, California, was placed in service Jan. 15. The plant that has been placed on the lines contains two horizontal units each of 10,000-kw. capacity. The opening of the plant was delayed two weeks by the bursting of the steel penstock the first time that it was filled with water.

The Delta Electric & Water Company, of Everett, Wash., has received permit from Marvin Chase, Washington supervisor of hydraulics, for the installation of a hydroelectric power plant on Pilchuck Creek in Snohomish County. The proposed development will cost $200,000 and will provide for a 550-hp. plant, with a concrete arch dam, 70 ft. high and 317 ft. long on top.

Woman Has City Electrician's Examination Certificate

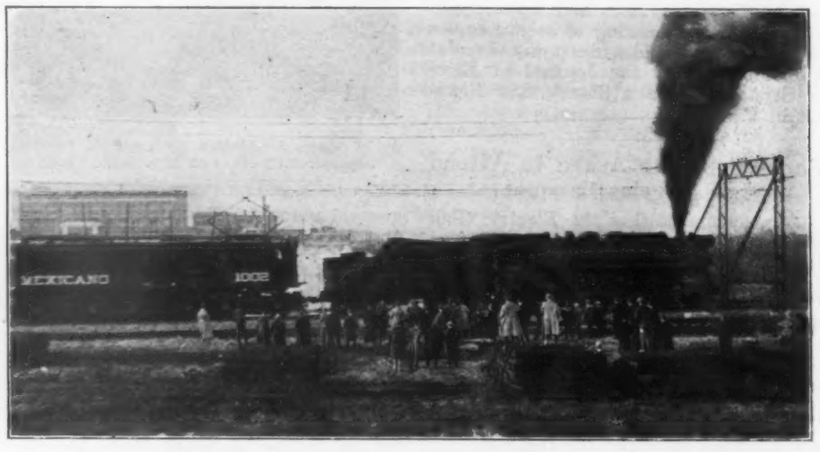
Electricity invaded woman's domain, and now a woman retaliates by invading electricity's domain. Mrs. Louise B. Green, of San Diego, won the distinction of being the first woman to be granted the master electrician's certificate for the city, when she passed the examination with high honors before City Electrical Inspector A. E. Johnstone, recently.

Mrs. Green, a widow, inherited her husband's electrical supply business. City ordinances require that each such establishment have connected with it a master electrician. When Mrs. Green continued to have difficulty to hire a master electrician for the business she determined to fill the place herself. Mrs. Green passed the municipal examination, said to be a very thorough one, to the satisfaction of the city electrician and so now fills the master electrician vacancy herself.

Electric and Steam Locomotives Entered Tug-of-War

Two important tests were recently made with the electric locomotive manufactured by the General Electric Company and the American Locomotive Company for the Mexican Railway Company, Ltd.—a tug-of-war and a regeneration test. In the tug-of-war a steam locomotive of the Mikado type, with practically the same weight on drivers as the electric unit and equipped with booster, superheater and all other improvements, was used. Manned by a picked crew, it was coupled to the electric unit and, at a given signal, each engineer applied power in opposite directions and attempted to pull the other. The steam machine was allowed to get a start and the electric locomotive then slowed it up, stopped it and finally pulled it in the opposite direction. The victory of electricity over steam was, in practically all cases, decisive.

In the regenerative tests, the same steam locomotive was coupled to the Mexican unit which was pulled along the rails in simulation of a down grade. The steam locomotive exerted its maximum power and a speed of about 14 m.p.h. was attained. About 1,800 hp. was sent back into the system, but it was estimated that two steam locomotives of the same type would be required to return full power to the line.



One hundred and fifty-ton, 3,000-volt electric locomotive built for the Mexican Railway Company, Ltd., pulling against a Mikado type steam locomotive.

Sacramento Electrical Men Are Dinner Guests of Union

One hundred and ten men of the electrical industry of Sacramento, Calif., met in the dining room of the Hotel Land in that city on the evening of Jan. 23 as the guests of the members of Electrical Workers, No. 340. The meeting was in the form of a dinner followed by speeches from men of the industry and was the first one where electrical workers, contractor-dealers, jobbers and power company men were all in attendance to discuss the subject of cooperation.

Cooperation—the subject upon which every speaker based his talk, was heartily commended by everyone in attendance. Interest in the meeting was evidenced by the fact that over eighty members of the Sacramento union were present and every member of the Electrical Contractors' and Dealers' Association had one or two representatives there.

Henry Tilsen, president of the Sacramento union, acted as toastmaster at the meeting. A. H. Feely, business agent of the organization, was the first speaker of the evening and told of the union's idea of cooperation and of the reasons for the union men suggesting the meeting. C. V. Snyder, Electric Supply Company and president of the contractor-dealers' association, expressed the gratitude of the contractors upon being able to meet their employees in such a way and J. C. Hobrecht, J. C. Hobrecht Company, in a short address told the men at the meeting of the benefits that could be secured from cooperation.

As part of the educational entertainment provided for the meeting, an illustrated talk, dealing with the obstacles that are met by power companies in supplying uninterrupted service and of the work of the system dispatcher, was presented by F. R. George of the Pacific Gas and Electric Company. Following this, Mr. George presented moving pictures showing some of the hydroelectric developments of the Pacific Gas and Electric Company.

Arthur E. Rowe, of Garnett Young & Company, San Francisco, was the principal speaker of the evening. Mr. Rowe in an exceptionally interesting talk told how cooperation was the thing to be aimed at by everyone in the industry, and that selling the firm was one of the best methods in which the firm's employees could evidence their cooperation. He told that the Courteous Service Club of the Pacific Coast Electrical Association was built upon the idea of cooperation and urged everyone at the meeting to join the club.

Investigation of Boiler House Economies Made in Denver

Boiler house economies is a subject of special consideration of the engineers of the western division of the Public Service Company of Colorado, according to a recent report from the office of Charles A. Semrad, manager of the division.

A new 600-hp. boiler with six zone forced draft stokers has just been placed in service at the Cheyenne, Wyo., steam plant and final adjustments are waiting the completion of the coal and ash handling equipment.

Experiments at the Lafayette, Colo., plant have proved the economy of a new firing system in conjunction with the use of a frequency changer to handle the railroad load. A change has also been made in the Mason forced draft regulator by building up the sliding cam until the desired angle was obtained which would give the slowest cutting-out and the fastest cutting-in of the air pressure.

The Pacific Gas and Electric Company has announced plans for the reconstruction of the lighting system and for other improvements in Oroville, Calif., amounting to approximately $100,000. The work contemplated includes replacing practically every pole and street light and almost complete rewiring, construction of a new reservoir and new mains.

Books and Bulletins

TECHNICAL WRITING

By T. A. RICKARD, Associate of the Royal School of Mines, formerly Editor of the "Engineering and Mining Journal," "The Mining Magazine," and the "Mining and Scientific Press." Contributing Editor of the "Engineering and Mining Journal-Press." Formerly State Geologist of Colorado. Lecturer at the Universities of Harvard, Columbia, McGill, Stanford and California. Second Edition. 337 pages, 5 by 7½ in. Cloth. $2. Published by John Wiley & Sons, Inc., New York, N. Y.

The average engineer has one characteristic for which he is often justly criticised; his use of the English language, whether in writing or in public speaking, is lamentable. As an exemplar of a profession based on accuracy and efficiency, he employs words—one of his most important tools—inaccurately and inefficiently.

In his four lectures upon which this book is based, Mr. Rickard aimed to call attention to this fault at its source,—the university. The result has been immediate. The book is employed in the engineering departments of universities and colleges where there is yet an opportunity to impress upon the minds of technical students the importance of writing coherently, concisely and correctly. But its application has not stopped here. Those engineers, who have realized the necessity for precision of language, have found the book immeasurably helpful in correcting the faulty English which limited their expression.

It is difficult to say whether Mr. Rickard is primarily an editor or an engineer. Without doubt, there is no one better qualified than he to write such a book. Eighteen years of experience as a mining engineer and twenty-three as an editor have furnished him with a backbone of observation and practice that is admirably reflected in his book.

The second edition has been largely rewritten. Chapters on the subjunctive, "shall and will," on punctuation and on "The Wrong Word" have been added, thereby rounding out the subject more fully than before.

Included among the more important chapters are those on clearness and precision, the relative pronouns, construction, composition and style. A chapter is also devoted to superlatives.

The book is notably concise, clear, practical and direct in contrast to other texts on English composition. It can be unquestionably recommended to those students of engineering who realize that a knowledge of English and the ability to write terse reports, to state facts plainly and to convey information intelligently, are worthwhile and profitable accomplishments.

PRACTICAL CONTROL OF ELECTRICAL ENERGY

By ALFRED GEORGE COLLIS. 160 pages. 142 figures. Published by Henry Frowde and Hodder & Stroughton (Oxford Technical Publications).

British practice in the control of electrical machinery is treated in this book in that it contains descriptive technical data covering the design of electrical apparatus manufactured in England. According to the author it is his intention to present in the most concise form simple data and principles with the object of explaining and solving alternating and direct current problems without the introduction of complicated equations and formulas.

The first chapter of the book is devoted to a description of the terms of expression used in explaining electrical phenomena, to which twenty-six pages are devoted. Electrical indicating and measuring instruments as well as the various systems of connections as ordinarily used in generation and distribution are treated in the second chapter, covering thirty-six pages.

The third chapter, to which thirty-nine pages are allotted, is in the opinion of the reviewer the most valuable one in the book and is a fairly thorough treatment of the application of protective devices. English practice in the use of protective gear, as it is termed, is treated in sufficient detail to give a good idea of the use and value of such devices. The protection of generators and high tension cable against internal faults is treated almost exclusively. Some reference is made to American practice but the application of protective relays to high tension overhead transmission networks as used in the United States has very little space devoted to it.

Miscellaneous electrical apparatus covering power house equipment such as oil circuit breakers, direct current machine, alternating current motors, field regulators, and switchboards are covered in the next chapter of forty-seven pages and a final short chapter is devoted to notes on factory and mining regulations.

In a book of this size the space available does not permit of sufficient detailed treatment of the subjects covered. Consequently, some important subjects such as oil circuit breakers, for example, are not treated as thoroughly as their importance in the control of electrical energy justifies. The diagrams are sufficiently clear for purpose of description but it is to be regretted that more photographs are not included in the book. Several folding plates showing detailed wiring diagrams of switchboards and electrical machines, illustrating typical schemes of connections, add to the value of the book.

E. R. S.

Meetings

Marysville Electric Club Holds Dinner and Meeting

The newly organized Electrical Development Association of Marysville, Calif., held its first get-together dinner at the Western Hotel, in that city, on Jan. 8. The attendance was practically 100 per cent and the meeting was notable for its enthusiasm and for the cooperative spirit which was evidenced.

Dinner was served at 6:30 and George W. Roberts, president of the association, acted as toastmaster. During the dinner there were several impromptu speeches by various members and guests. Oliver E. Sholders, sales engineer of the Pacific Gas and Electric Company, San Francisco, Calif., spoke on the attitude of that company toward the contractor-dealer and of the support which the company can give to cooperative dealer movements. Short addresses were made by George Young, of Marysville, C. F. Berg, of Marysville, Burton Y. Gibson, Pacific Coast representative for Walker & Pratt Manufacturing Company, and by Fred A. Peck, superintendent of new business for the Pacific Gas and Electric Company, Marysville. A short address was given by George W. Barker, associate editor of the Journal of Electricity, on merchandising and on the value of cooperative sales efforts.

This association will hold monthly dinner meetings and has mapped out constructive plans for the betterment of merchandising conditions in the territory covered by its members, particularly with reference to standardization of installation requirements and conditions.

To Hold A.I.E.E. Convention at Philadelphia Feb. 4-8

The mid-winter convention of the American Institute of Electrical Engineers will be held at the Bellevue-Stratford Hotel, Philadelphia, Pa., Feb. 4-8. The convention delegates will celebrate the fortieth anniversary of the founding of the Institute at that time.

In addition to the regular technical sessions which will be held in the mornings, afternoons and evenings, a number of trips have been planned for the visitors. At the evening meeting on Feb. 4, the Edison Medal for meritorious achievement in electrical science, electrical engineering or the electrical arts, will be presented to John W. Lieb, vice-president, New York Edison Company and the 1923 winner of the medal.

Electrical Demonstration Given Before Portland Meeting

An electrical demonstration was staged at the members' forum of the Portland, Ore., Chamber of Commerce as a celebration of the 200th anniversary of Benjamin Franklin's birth. It took the form of the artificial production of lightning—discharging into the jar electrical flashes of high frequency and of between 500,000 and 1,000,000 volts. This was identical with the demonstration staged by Charles P. Steinmetz.

The actual production of the lightning was in the hands of Walter Haynes, dean of the school of electrical engineering of the Y.M.C.A. He was assisted by D. W. Proebstel, operating inspector of the Portland Railway, Light & Power Company, and Harry P. Cramer, of the electrical engineering staff of the same company. A novel feature of the exhibition was a demonstration of just how Benjamin Franklin made his electrical discovery when he brought the lightning down from the sky during a heavy thunder storm by means of a kite and a key.

Banquet Held by San Francisco Contractor-Dealers

Nearly two hundred and fifty men and women were in attendance at the annual banquet of the Electrical Contractors' and Dealers' Association of San Francisco, Calif., held at Tait's at the Beach in San Francisco on the evening of Jan. 26. Guests at the banquet, in addition to members of the association and their wives, included representatives of San Francisco jobbers, manufacturers' representatives, manufacturers and power companies. A number of Oakland and Sacramento people were also present.

The banquet was conducted upon strictly informal lines, the Pagoda being reserved for the party. Entertainment was provided during the serving of the dinner and following this the evening was devoted to dancing.

During one of the intermissions Arthur E. Rowe, as a representative of the association, presented the association's tokens of esteem to Victor Lemoge, retiring president, and to Albert Elkins, retiring secretary. Both of the men who were honored by the association made short talks thanking their associates for the gifts.

COMING EVENTS

American Institute of Electrical Engineers—
Mid-winter Convention—Philadelphia, Pa.
Feb. 4-8, 1924

New Mexico Public Utilities Association—
Annual Convention—Albuquerque, N. M.
Feb. 18-20, 1924

The annual convention of the New Mexico Public Utilities Association will be held at Albuquerque, N. M., Feb. 18, 19, 20, according to an announcement just issued by the secretary, Charles E. Toogood of that city. The meeting will be held in the new million dollar hotel, the Franciscan. Plans are being made to entertain about fifty visitors. E. A. Bradner, manager of the Las Vegas Light & Power Company, is the retiring president.

During the month of January Norwood W. Brockett, vice-president of the Puget Sound Power & Light Company, Seattle, Wash., addressed the Spokane Rotary Club and also the Associated Engineers on the subject of the Erickson Bill. The two meetings were well attended by representative business men, and Mr. Brockett's searching analysis of the weaknesses of this so-called "Enabling Act" was very well received.

Duplicate Franklin's Experiment at Los Angeles Meeting

On the anniversary of Benjamin Franklin's birth, there were several meetings staged in Los Angeles, Calif., in honor of his memory, two of the principal ones being at the Grauman's Metropolitan Theater at 10 a.m. and another at the Biltmore Hotel at a luncheon of the Chamber of Commerce.

The meeting at Grauman's Metropolitan Theater was arranged through the cooperation of the Southern California Edison Company and the General Electric Company, with Arthur L. Spring of the General Electric Company and Mr. Peterman of the Southern California Edison Company in charge.

At this meeting there was a demonstration arranged, duplicating Benjamin Franklin's kite experiment. For this demonstration, a large kite was placed high over the stage and a cord leading out into the audience with a key attached at the end. Artificial lightning was produced and transmitted through the rod on the kite down to the key, causing a spark which was distinctly noticeable to the audience.

In introducing the above demonstration, Mr. Spring spoke as follows:

"Benjamin Franklin played a very important part in the early development of electricity. Some of his theories of that time are today accepted as established facts. He was one of the first to contend that lightning and electricity were one and the same thing and decided to prove this. In June, 1752, he flew his kite with a pointed wire at the top and a key at the lower end of the string. With the equipment which we have here we are going to perform Franklin's kite experiment. When Franklin brought his knuckle near the key a spark made its appearance. This proved that lightning and electricity were one and the same thing. With this fact established, Franklin set about to find a way to protect buildings from lightning and so invented the lightning rod.

"Today artificial lightning is made in the laboratory. In the research laboratory of the General Electric Company at Pittsfield lightning bolts of 2,100,000 volts are hurled at will and these experiments today are playing an important part in the development of high voltage transmission of electrical energy.

"Little did Benjamin Franklin realize that the industry, in the early history of which he played such an important part, would become so vital a factor in modern civilization. Think of it—the automobile, the airplane, the street car, the telephone, the telegraph and even radio are all dependent upon this subtle fluid which lights our homes and turns the wheels of industry."

After the demonstration, an address on Benjamin Franklin was delivered by John Stephen McGroarty, author of the Mission Play. The meeting was followed by a meeting at the Biltmore Hotel by the Chamber of Commerce, when a similar demonstration was arranged which was followed by an address by Frederick Warde.

Architects of Denver, Colo., are to be the guests of the Electrical Cooperative League of that city on Feb. 5, when a special banquet of the league is held at the Hotel Metropole in Denver.

Manufacturer, Dealer and Jobber Activities

The Ward Leonard Electric Company, Mount Vernon, N. Y., has just issued its Bulletin No. 57 dealing with Vitrohm speed regulators. This bulletin will be furnished upon request to the factory.

The F. W. Wakefield Brass Company, Vermillion, Ohio, has recently issued new and revised data sheets on "Red Spot" lighting specialties. The several publications include data sheets on the standard "Red Spot" line of hangers, accessory fixtures and materials and on the new porcelain enamel kitchen lighting units.

Dossert & Company, New York, N. Y., has just received from the press the twentieth year catalog of Dossert solderless connectors for stranded and solid wires, rods and tubing. It marks a very substantial enlargement over previous catalogs in the matter of data and information, brought up to the minute. The book further takes up the subject of putting together a typical Dossert joint, illustrating it completely. On one page are presented twelve of the most frequently encountered types of joints and how they can be made into Dossert joints.

The Allis-Chalmers Manufacturing Company, Milwaukee, Wis., has announced that it has put on the market a line of centrifugal pumps for fire protection that are of the single stage type and meet with Underwriters' Laboratories, Inc., specifications. The cost of the single stage pump is claimed to be less than that of the multistage type.

The Westinghouse Lamp Company has recently prepared a two-reel film entitled "Show 'Em How." The film is designed to be shown before electrical men of the country. The company offers the use of the film without charge to any organization in the electrical industry that will pay the express charges to and from New York.

The Pittsburgh Transformer Company, Pittsburgh, Pa., has recently opened a branch office at 531 Call Building, San Francisco, Calif. J. G. Corrin, formerly sales manager of the company with headquarters at Pittsburgh, will be in charge of the newly opened branch.

Benjamin Electric Manufacturing Company has announced from its Chicago, Ill., office that during the week of Feb. 9-14 it will conduct a Valentine week window dressing contest. Benjamin two-way plugs are to be featured in the contest. The trim for the windows will be furnished by the manufacturer.

Reiman Wholesale Electric Company, Los Angeles, Calif., has announced that it has recently been appointed southern California distributor for Bryan-Marsh Mazda lamps.

The Thomas Goldschmidt Corporation, New York, N. Y., has recently announced the appointment of Harry E. Sherwin as marketing manager of the organization which handles radio equipment. Mr. Sherwin was formerly with Robert H. Ingersoll & Brother and was sales manager for the A. C. Gilbert Company of New Haven, Conn.

The Eggers Pole & Supply Company of Spokane, Wash., whose new butt treating plant was installed last summer, is planning on increasing its output by adding a night shift in the near future. This concern, which ships red cedar poles to every state in the Union, has a capacity of 75,000 poles per year. At present, the output is 4,000 per month.

Engle-Reid Company has recently announced its entry into the field handling materials for utilities and manufacturers. Offices are maintained at 149 California Street, San Francisco, and Terminal Sales Building, Los Angeles. The company is Pacific Coast sales agent for the Scovill Manufacturing Company, Waterbury, Conn., and is representative for the Barnes-Lindley Manufacturing Company, Portland, Ore., manufacturers of crossarms exclusively, and for the Naugle Pole & Tie Company, Chicago, Ill. George D. Engle, who is in charge of the Los Angeles office, has been connected with the National Conduit & Cable Company for several years. Kenneth M. Reid, in charge of the San Francisco office, has been in the export end of the business for several years and more recently has been selling materials to the jobbers and utilities on the Pacific Coast.

Denver, Colo., seems to be the home of pretty girls. Anyhow, this is the second picture of attractive nature that has come from Denver. The young lady shown above is Miss Janette Edwards, who as the electrical queen represented the Electrical Cooperative League of Denver at the Women's Press Club pageant held in that city.

The Premier Electric Distributing Company of Denver has established a radio department in connection with its appliance business. This company was recently given the distribution of Savage washing machines in Denver.

Allied Industries, Inc., San Francisco, Calif., has been appointed Pacific Coast distributor for the General Porcelain Company, Parkersburg, W. Va. They will carry stocks for quick delivery at all their Pacific Coast branches. H. S. Perkins, who has been representing the General Porcelain Company on the Pacific Coast, will continue in that position, working through the Allied Industries.

The Oshkosh Manufacturing Company, Oshkosh, Wis., announces a change in the firm name although there will be no change in the personnel or control of the firm. In the future the concern will be known as the Leach Company and the address will be the same as that of the past. B. C. Holst represents the Leach Company in San Francisco, Calif.

The United Electric Company, Canton, Ohio, has appointed A. O. Eagle district manager for the mountain region in the distribution of Ohio vacuum cleaners, with headquarters at Denver, Colo.

John Hancock Electrical Company, Denver, Colo., after a number of years in the retail section of the city, has moved to 1420 Sixteenth Street in the wholesale district and closer to the company factory at 1420 Wazee Street. The sale of appliances will be discontinued and emphasis will be given to the distribution of Columbalite commercial lighting units.

The Public Service Company of Colorado in Denver, Colo., has reorganized its commercial lighting department with Charles E. Addie as superintendent. The city has been divided into seven sections with a representative in each section. Electric signs manufactured by the company are featured along with commercial units.

The Electrical Supply & Construction Company in Denver, Colo., has moved to 16 Arapahoe Street where a larger store and display room has been provided for the display and sale of house lighting fixtures.

Wipplinger & Son is the name of the new lighting fixture manufacturing firm in Denver, Colo., at 1540 Blake Street.

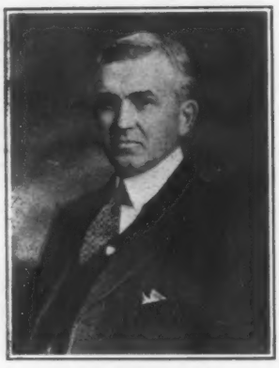
The Apex Electrical Distributing Company, Cleveland, Ohio, has recently placed on the market a new small electric vacuum cleaner which is designed to be carried by hand from one room to another. No wheels or handle are attached to the cleaner which is known as the Rotarex electric vacuum cleaner. The body of the cleaner is of sheet aluminum and all parts are encased in this covering. The device complete with attachments weighs 7½ lb.

The Pelton Water Wheel Company, San Francisco, Calif., has recently published Bulletin No. 19. The publication, which is in catalog form, contains a complete treatise on impulse type Pelton water wheels, parts and accessories. A catalog covering reaction type turbines will be issued in the near future.

The General Electric Company has recently announced that it has created a Southwestern District to handle its apparatus in Texas, Oklahoma, southern New Mexico and southeastern Arizona. The Southwest General Electric Company as such will continue to act as distributing jobber in the southwestern territory. C. W. Hobson has been appointed southwestern manager and L. T. Blaisdell, district manager.

Personals

R. J. Middleton, assistant chief engineer of the Chicago, Milwaukee & St. Paul Ry. Co., was recently elected president of the Engineers' Club of Seattle to serve during 1924, succeeding E. J. Bartells. Mr. Middleton is a graduate civil engineer, having 22 years of experience, 18 of which have been with the Chicago, Milwaukee & St. Paul Ry. Co. Entering the service of this corporation in 1906 as bridge draftsman, he has received successive promotions to positions of assistant engineer on construction, engineer of track elevation, valuation engineer and for the past five and one-half years has been assistant chief engineer of lines west of the Missouri River with offices in the White Building, Seattle.



R. J. MIDDLETON

C. E. Wilson has been made managing engineer of the conduit and wire division of the General Electric Company's Bridgeport, Conn., Works. In addition to the responsibilities of this position, he will have general supervision over the manufacture of rigid conduit at the New Kensington (Pa.) plant of that company.

Harry E. McAfee, assistant vice-president of the Mountain States Telephone Company, Denver, Colo., has been made vice-president of that company.

R. C. W. Libbey, for over fourteen years with the Simplex Electric Heating Company, Cambridge, Mass., and for the past four years located on the Pacific Coast, has been appointed representative for Landers, Frary & Clark in the states of Montana, Idaho and Utah. Mr. Libbey has just spent some time at the factory in New Britain, Conn., and is now making the rounds of his new territory.

Leonard A. Hobbs, California representative for the Edwin F. Guth Company, St. Louis, Mo., is in San Francisco on business for the firm.

Harry W. Lippert, California and Nevada representative for the Estate Stove Company, Hamilton, Ohio, is attending a sales conference at the factory.

Herman W. Schroeder has been appointed district auditor of the southwestern district of the General Electric Company, following the recent creation of this district by that company.

C. T. Mess, superintendent of the Sacramento, Calif., division of the Great Western Power Company, has resigned from that company to become assistant engineer with the California Railroad Commission.

M. R. Stowell, for many years sales manager for the American Refractories Company, has recently joined the staff of the Vitrefax Company in the capacity of sales manager of the Western division covering the entire Pacific Coast and southwestern states.

J. T. Littlefield, formerly with the Yale Electric Corporation, San Francisco, Calif., has severed his connection with that firm and has joined the sales staff of Listenwalter & Gough, Inc., San Francisco, Calif. Mr. Littlefield will specialize on dealer relations and the sale of Royal vacuum cleaners and washing machines.

J. G. Corrin, who has for some time been sales manager for the Pittsburgh Transformer Company, Pittsburgh, Pa., has been appointed to take charge of the San Francisco, Calif., office of the company which has been opened at 531 Call Building.

Jacob Kahn, president of the Capital Electric Company, Salt Lake City, Utah, was recently in San Francisco on business. While on the Coast Mr. Kahn familiarized himself with the details of the 1924 "Check" Seal program of the Pacific States Electric Company.

S. E. Uncapher and **O. B. Rinehart** have been appointed assistants to **A. J. Francis,** manager of fractional horsepower motor sales at the General Electric Company's plant in Fort Wayne, Ind. These appointments follow the recent resignation of **S. P. Hirsch** as assistant manager of this department.

Kenneth L. Francis, manager of the retail department of the Albert Sechrist Manufacturing Company in Denver, Colo., was elected by the manufacturers' division of the Electrical Cooperative League in that city at a recent meeting to represent the division on the Advisory Board in the place made vacant by R. W. Elliott, who resigned to enter the jobbing business. As honorary secretary of the organization Mr. Elliott was succeeded by **E. A. Scott,** a well known electragist.

Charles A. Collier, Georgia Railway & Power Company, Atlanta, Ga.; **M. A. Curran,** manager, Western Electric Company, Cincinnati, Ohio; **R. E. Fisher,** vice-president, Pacific Gas and Electric Company, San Francisco, Calif.; **Joseph Fowler,** president, Fowler Electric Company, Memphis, Tenn.; **J. E. North,** commercial agent, Cleveland Electric Illuminating Company, Cleveland, Ohio; **L. L. Strauss,** New York City; and **Earl E. Whitehorne,** commercial editor, Electrical World, New York City, have been appointed by **W. E. Robertson,** vice-president of the Robertson Cataract Electric Company, Buffalo, N. Y., who was chairman of the conference of representatives of local electrical leagues held on Association Island in September, 1923, to act upon a committee to develop a plan for the national organization of local electrical leagues. Mr. Whitehorne is chairman of the committee.

W. H. Coleman has been appointed merchandise manager of the Chicago, Ill., commercial district of the General Electric Company, according to a recent announcement by H. L. Munroe, manager of that district.

W. M. Ross, of the Rio Vista station of the Great Western Power Company, has been transferred to Pittsburg, Calif., as assistant superintendent.

A. B. C. Dohrmann has been elected a member of the Board of Directors of the Pacific Gas and Electric Company, San Francisco, Calif. Mr. Dohrmann is the active head of large merchandising establishments in Los Angeles, Oakland, San Jose, San Diego, Stockton and elsewhere. He is a director of the Federal Reserve Bank of San Francisco, president of the Yosemite National Park Company, the Emporium and Nathan-Dohrmann Company, and chairman of the Palace Hardware Company, San Francisco.

H. W. Young, president of the Delta-Star Electric Company, Chicago, Ill., and Mrs. Young are touring France, Italy, Switzerland and other European countries. Mr. Young is making an investigation of high tension transmission lines. The couple will sail from Naples about Feb. 1 and should arrive in Chicago about Feb. 15.

C. W. Adams has been made manager of the Savage Arms Corporation for the Pacific Coast. His offices will be at 229 Rialto Building, San Francisco, Calif.

Walter F. Price, architectural representative of the California Electrical Cooperative Campaign since February, 1920, has been appointed executive secretary of the California State Association of Electrical Contractors and Dealers, effective Feb. 1, 1924, succeeding **J. W. Redpath,** resigned. Mr. Price is a graduate of the Van Der Naillen School of Engineering, and in the capacity of outside telephone engineer was in the employ of the Pacific Telephone & Telegraph Company for nine years. During his service with the California Electrical Cooperative Campaign he has had charge of the building of electrical homes in Oakland, Sacramento and various other California towns and has been very successful in selling the idea of the electrical home to architects and builders. Mr. Price's headquarters will be in the Call Building, San Francisco, Calif.

WALTER F. PRICE

L. E. Clark, manager, and **J. G. Marks**, treasurer, of Reiman Wholesale Electric Company, Los Angeles, Calif., have gone to Chicago, Ill., to attend the National Electric Fixture Manufacturers' exhibit. They will return to Los Angeles about Feb. 1.

W. H. Talbott has been elected president of the San Diego Consolidated Gas & Electric Company's Employees' Association for the year 1924.

Gray E. Miller of the Sewickley Electric Manufacturing Company of Sewickley, Pa., is making a tour of the Pacific Coast in the interest of his company and was a recent Los Angeles visitor. Mr. Miller was active in demonstrating the new Semco meter which his company manufactures.

F. L. Easton, district representative of the Economy Fuse Co. in Denver, Colo., is the chairman of a special manufacturers' committee appointed by that division of the Electrical Cooperative League to arrange a dinner and entertainment for the architects of the city, Feb. 5.

J. P. Kennedy, of the Western Electric Company, Chicago, Ill., is a recent visitor to San Francisco.

George P. Baldwin, manager of the merchandising department of the General Electric Company, Schenectady, N. Y., is in San Francisco, Calif., on business.

Miss Inez Thompson, of the Public Service Company of Colorado, Denver, Colo., has been appointed chairman of the Rocky Mountain Division of the Women's Public Information Committee of the National Electric Light Association. This division comprises the states of Colorado, Wyoming and New Mexico. The National Women's Public Information Committee is now in the third year of its work and splendid results have been accomplished in the various divisions where the work has been carried on. Utility executives

MISS INEZ THOMPSON

have taken a deep interest in its activities and have lent their support and cooperation to the movement to educate the women of the industry so that they in turn may do their part in promoting the public relations program which is at this time occupying a prominent place in the utility industry. No women's work has thus far been attempted in the Rocky Mountain division, but it is now planned to speedily form a committee to take up the work enthusiastically and energetically.

Frank H. Klippel has been made superintendent of the Sacramento, Calif., division of the Great Western Power Company and has been transferred to that city from Pittsburg, Calif.

R. H. Ober and **Joseph Jacobs**, both of Seattle, Wash., have associated themselves for the general practice of civil engineering under the firm name of Jacobs and Ober.

Charles M. Wright, formerly with North Coast Electric Company, Seattle, Wash., is now the Inland Empire representative for the Economy Fuse & Manufacturing Company of Chicago, Ill. Mr. Wright will make his headquarters at Spokane, Wash.

R. J. C. Wood, assistant electrical engineer for the Southern California Edison Company, Los Angeles, Calif., has been awarded the "Transmission Prize" which is offered each year by the American Institute of Electrical Engineers. Mr. Wood's paper, "Southern California Edison Company's 220-kv. Transmission Line and Some 220-kv. Research," won the certificate of award for 1922 and the cash prize of $100 which accompanies the award. The prize is given each year by the Committee of Awards to the author of the paper that is designated by the Institute committee as the most worthy paper dealing with the art of transmitting electrical energy over considerable disances.

C. W. Hunt, Jr., has been appointed to take charge of the washing machine division of the Savage Arms Corporation. Mr. Hunt will make his headquarters at 229 Rialto Building, San Francisco, Calif.

A. R. Small, vice-president of the Underwriters' Laboratories, has announced that hereafter his offices will be at 109 Leonard Street, New York City. Mr. Small will transact all future business from that address.

B. C. Holst, San Francisco, Calif., has been appointed representative in the western territory for the Leach Company, formerly the Oshkosh Manufacturing Company, Oshkosh, Wis.

James Hartness, former governor of Vermont, and past president of the American Society of Mechanical Engineers, was elected president of the American Engineering Council to succeed Dean Mortimer E. Cooley of the University of Michigan, at the annual meeting of the Council, which was held in Washington Jan. 10 and 11.

Arthur Purdon, Pacific Coast representative for the Crocker-Wheeler Company, Ampere, N. J., has recently returned from a trip to the factory.

E. R. Stauffacher, protection engineer for the Southern California Edison Company, Los Angeles, Calif., has left for Birmingham, Ala., and Philadelphia, Pa., as well as other eastern cities. He will return in about three weeks.

George B. Thomas, educational director of the Western Electric Company, New York City, is visiting Pacific Coast cities and the branch offices of the company located in that territory. He has addressed the universities of the Northwest and also the meetings of the American Institute of Electrical Engineers. Mr. Thomas will visit Stanford University and the University of California before proceeding to Los Angeles. The general subject which Mr. Thomas treats in his discourses is that of Audition.

Charles E. Canada, sales engineer with the General Electric Company in the Northwest for the past 13 years, has become associated with W. A. Ramsay Company, Ltd., of Honolulu. This company is the Hawaiian representative for the General Electric Company, the Pelton Water Wheel Company, Charles C. Moore & Company and other manufacturers. Mr. Canada was graduated from the Sheffield Scientic School of Yale University in the class of 1907. After leaving college he spent some time in

CHARLES E. CANADA

the test department of the General Electric Company in the Schenectady and Pittsfield works and in 1911 he joined the sales force of the company in the Northwest where he has remained until this time.

F. H. Burnaby, vice-president of the Southern California Edison Company, Los Angeles, Calif., was recently in San Francisco on business for his company.

George P. Wells of the Wells-Morris Manufacturing Company of San Francisco, Calif., manufacturers of the Wells waffle iron and other electrical appliances, was a recent Los Angeles visitor.

Obituary

William Albert Weight, proprietor of the Sterling Electrical Company of Sacramento, Calif., died Jan. 18, 1924, following an operation for appendicitis, contracting pneumonia. Mr. Weight was born in Biggs, Butte County, Calif., in 1879. After obtaining his preliminary education, he became a stenographer and for a period of four years he studied law. Mr. Weight later attended Stanford University after which he entered the California National Bank. He was also with the Wells Fargo Nevada National Bank in San Francisco and the Central Bank in Oakland. Mr. Weight organized the Sterling Electrical Company in 1918.

E. C. Boquet, for the past fifteen years manager of the Southern California Edison Company's offices in the Santa Monica Bay district, dropped dead on Jan. 19. Mr. Boquet had been connected with the Southern California Edison Company since his first employment at the age of seventeen.

Trade Outlook

San Francisco

Retail buying continues satisfactory with preference for seasonal lines. The exceptionally mild weather has reacted somewhat on furnishings and clothing but other apparel lines are strong.

Bank statements show a well intrenched financial position with strong reserves. Money is available for legitimate industrial and commercial development. It is reported that several large eastern firms contemplate Pacific Coast factories or assembling plants. The San Francisco Bay region is a strenuous competitor for the location of these industrials.

Oil prices have stiffened and advanced. Metals are strong with some advances.

Construction continues with several large commercial enterprises under way or about to start. Domestic construction has not abated and materials are in heavy demand. Electrical equipment is sold for these structures in increasing amount. Air heaters and ranges as well as water heaters are selling easily and manufacturers are behind in deliveries of some types of this equipment.

Power company developments are proceeding rapidly and energy consumption per capita shows a steady increase, thus indicating a generally healthy condition.

Portland

Business conditions in Oregon during the coming year will be good, according to the best posted authorities, and the state is expected to rank with the most prosperous.

Agricultural conditions are decidedly on the mend. The wool growers have made sharp recoveries from their losses of a few years ago; dairying conditions are good; fruit marketing as a whole has been satisfactory, and there is improvement in the conditions governing livestock. While the situation of the wheat grower is not satisfactory, the outlook is hopeful.

In the lumber industry, which employs more than 60 per cent of Oregon's labor, there is a certainty of continued good times. This major industry will have much to do with Oregon's prosperity.

Portland and vicinity probably never had a better year than 1923, and there is no apparent reason why 1924 should not be equally good or better.

All this means big business for the electrical industry. The central stations have already placed orders for much heavy equipment to take care of the year's program, and expansion is everywhere apparent.

Los Angeles

The electrical business in Los Angeles maintained a very high standard during January, the past month having been one of the best in its history for this season of the year. This is true in all branches.

Electrical manufacturers report considerable activity in all lines, but especially in the industrial and supply lines. The one branch that is not up to the others at the present time is the sale of small motors, which slumped a little. The electrical wholesale business is also beginning wonderfully well, and there is every indication from the start the new year has obtained that 1924 will be a prosperous one for the industry in this section. Electrical retailers report considerable activity even after the holiday rush, and January has proved an excellent month for them as well as for the manufacturers and wholesalers.

The sale of radio apparatus and supplies has continued and is expected to increase materially during the coming month due to the radio exposition which will open at the Biltmore Hotel on Feb. 5.

The building permits for the first fifteen days of January, 1924, amounted to 2,500 with an estimated valuation of $5,732,009, as against 2,164 permits valued at $4,774,327 for the corresponding period in 1923, an increase of about 20 per cent. Bank clearings for the same period of comparison amounted in 1924 to $332,456,511.52, an increase of approximately 30 per cent over 1923 clearings, which were $257,156,769.17.

Seattle

Seattle enters the new year with an encouraging record of growth in practically every line during 1923 and bright prospects for a continuance throughout the present year. Lumber, shipping, construction, bank clearances, stocks and bonds all report a healthy growth and an optimistic outlook.

The Seattle Retail Credit Association states a decided advance in credit buying was made during the year just past, and the volume of business done by the association throughout 1923 was 25 per cent higher than for 1922.

Electrical retailers and jobbing houses, as a whole, show a steady improvement from week to week in sales volume, particularly along the lines of fixtures, appliances, house-wiring devices, etc.

There is an encouraging increase in the demand for heavier apparatus, including motors and generators, with sales of transmission line equipment satisfactory, considering the season of the year. The number of important power extensions and improvements planned for 1924 presage a good year for this sort of material and equipment.

Stocks in most lines are reported in good condition. Prices, with a few minor exceptions, remain firm. Collections are fair to good.

Salt Lake City

While the usual seasonal quiet prevails in many lines of business, general conditions in the intermountain section are very satisfactory. A new era of industrial development is well under way, and there is a pronounced feeling of optimism on every hand.

In spite of some declines in metal prices, the mining industry is on a substantial basis, and there seems to be no indications of any material curtailment in mining operations.

Conditions in the agricultural districts are much better than for some time past.

In all branches of the electrical industry business was better during 1923 than in the preceding year, and the outlook for 1924 is exceedingly bright. New industries, new homes and increased commercial activities are creating new demands for electrical energy, appliances, etc.

Collections are improving steadily. The banks of Salt Lake City are in excellent condition and well equipped to take care of the demands of expanding business.

It may be safely stated that conditions are more encouraging in this section than they have been for several years past, and business interests generally feel that the upward trend will continue and develop in volume.

Denver

In comparison with a year ago, the Rocky Mountain region, especially Colorado and Wyoming, is resisting with much greater success than the rest of the Tenth Federal Reserve district the tendency of business to slow down. This is attested by the volume of checks cashed, the comparison being far more favorable for Denver and the other cities in the western part of the district than for those on the Missouri River. Business is better here than the average for the entire country, according to Federal Reserve reports.

Extra dividends by sugar companies, the opening of new oil wells in northwestern Colorado, and a number of new construction projects have added to the optimistic tone of business conditions.

The situation of the electrical industry is much better than many of its members claim. Admitted that wiring prices are low, jobbers' reports indicate an increasing volume which places the matter of net profits in the contractor's or dealer's hands. In appliances there is the usual after-the-holiday lull, but radio trade is unusually active.

Spokane

From all indications, Spokane and the Inland Empire are facing a very prosperous year, with the general feeling better than it has been since 1920.

In most of the local woodworking plants the present output is slightly above the usual winter average. A new plant for making frame and sash has been announced, construction to begin immediately. The operation of night shifts in a local sawmill and a frame and sash factory, and the statement of a furniture manufacturing plant that its 1923 business showed an increase of 84 per cent over 1922, with the expectation of a similar advance for 1924, indicate good progress in the woodworking industry.

The outlook for metalliferous mining throughout the Pacific Northwest for 1924 is very good. Development of several properties not yet producing has proved very satisfactory, while some of the big Coeur d'Alene producers are commencing 1924 with ore reserves larger than at the beginning of 1923. As a result of mining activity, a local concern handling rebuilt motors reports good business.

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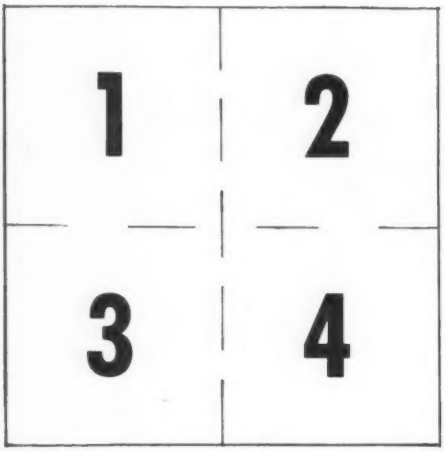

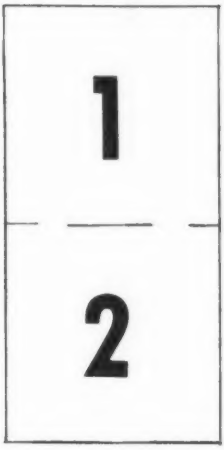

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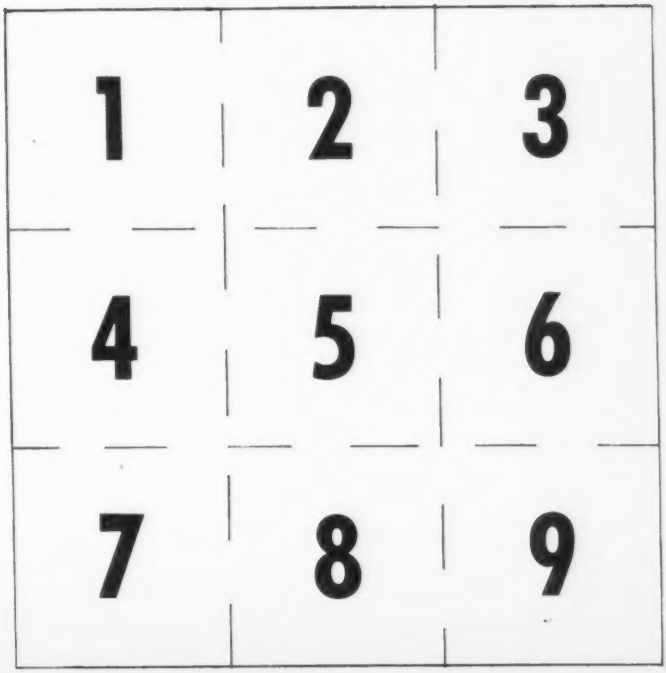

BANGOR ME.

PORTLAND ME.

BOSTON

PROVIDENCE

NEW YORK

PHILADELPHIA

BALTIMORE

WASHINGTON D.C.

RICHMOND VA.

NORFOLK VA.

RALEIGH N.C.

WILMINGTON N.C.

Comparative Latitude of Eastern Seaboard

Vancouver

Seattle

Portland

Spokane

Helena

Butte

Boise

Ogden

Salt Lake City

W A S H I N G T O N

O R E G O N

C A L I F O R N I A

N E V A D A

U T A H

Columbia R.

Willamette River

Umpqua River

Rogue River

Klamath River

Trinity R.

Eel River

Sacramento River

Pit River

Deschutes River

Snake River

Green River

183 Miles
6½ Hours
$ 6.38 Fare
$ 3.75 Pullman

309 Miles
11¼ Hours
$ 11.20 Fare
$ 4.50 Pullman

377 Miles
9½ Hours
$ 12.89 Fare
$ 4.50 Pullman

674 Miles
26¼ Hours
$ 24.33 Fare
$ 7.88 Pullman

441 Miles
19½ Hours
$ 17.15 Fare
$ 6.00 Pullman

397 Miles
16 Hours
$ 14.34 Fare
$ 4.50 Pullman

410 Miles
13 Hours
$ 14.40 Fare
$ 4.50 Pullman

774 Miles
26¾ Hours
$ 26.96 Fare
$ 8.25 Pullman

818 Miles
28¼ Hours
$ 36.24 Fare
$ 9.00 Pullman

San francisco to Kansas City
2014 Miles
64 Hours
$ 63.60 Fare
$ 19.88 Pullman

Ogden to
998 Mi
30 Ho
$ 35.82
$ 12.00

Population	1,465,100
Homes	367,000
Residential Consumers	259,650
Total Electric Consumers	283,900
Installed Generator Capacity	
Hydro Electric	254,000 KW
Steam	75,700 "

Population	483,250
Homes	108,800
Residential Consumers	45,600
Total Electric Consumers	63,693
Installed Generator Capacity	
Hydro Electric	71,000
Steam	9,000

Population	845,500
Homes	229,300
Residential Consumers	114,650
Total Electric Consumers	143,910
Installed Generator Capacity	
Hydro-Electric	110,500 KW
Steam	92,000 "

Population	84,200
Homes	21,180
Residential Consumers	16,950
Total Electric Consumers	19,100
Installed Generator Capacity	
Hydro-Electric	12,350
Steam	1,400

Population	485,300
Homes	101,500
Residential Consumers	

les
uns
ore
Pullman

465,100
367,000 N
sumers
259,650
Consumers
283,900
ator Capacity
ic - 254,000kw
75,700 "

Spokane

4 Miles
64 Hours
4.33 Fare
7.88 Pullman

River

377 Miles
9½ Hours
$12.89 Fare
$ 4.50 Pullman

Population 640,000
Homes 130,679
Residential Consumers 41,250
Total Electric Consumers 60,400
Installed Generator Capacity
Hydro-Electric 234,000
Steam 2,650

River

Helena

74 Miles
3 Hours
$2.64 Fare
$3.00 Pullman

Seattle to Minneapolis
1768 Miles
60 Hours
$62.78 Fare
$19.88 Pullman

Rivers

Butte

Billings

Yellowstone

Population 483,250
Homes 108,800
Residential Consumers 45,600
Total Electric Consumers 63,693
Installed Generator Capacity
Hydro Electric 11,000
Steam 9,000

Snake

Boise

397 Miles
16 Hours
$14.34 Fare
$ 4.50 Pullman

Population 220,700
Homes 56,510
Residential Consumers 22,100
Total Electric Consumers 28,190
Installed Generator Capacity
Hydro-Electric -
Steam 23,175
Gas Engines - 1,650

410 Miles
13 Hours
$14.40 Fare
$ 4.50 Pullman

Ogden to Omaha
990 Miles
30 Hours
$35.82 Fare
$12.00 Pullman

Portland to Omaha
1774 Miles
55 Hours
$64.01 Fare
$19.88 Pullman

North Platte R.

Cheyenne

84,200
21,180
mers
16,950
nsumers
19,100
tor Capacity
12,350
,400

Ogden

River

Salt Lake City

Salt Lake City to Kansas City
1266 Miles
39 Hours
$43.94 Fare
$12.75 Pullman

818 Miles
28¼ Hours
$36.24 Fare
$ 9.00 Pullman

Green River

Denver

Population 485,300
Homes 101,500
Residential Consumers

Population 1,015,000
Homes 251,000

Comparative Latitude of Eastern Sec

RICHMOND VA.

NORFOLK VA.

RALEIGH N.C.

WILMINGTON N.C.

CHARLESTON S.C.

SAVANNAH GA.

JACKSONVILLE FLA.

PALM BEACH FLA.

Hydro-Electric 110,500 KW
Steam 92,000 "

Klamath River

171 Miles
2 6 Hours
$ 2.96 Fare
$ 8.25 Pullman

Pit River

Eel River

Sacramento

Population 84,200
Homes 21,180
Residential Consumers 16,950
Total Electric Consumers 19,100
Installed Generator Capacity
Hydro-Electric 12,350
Steam 7,400

410 Miles
13 Hours
$ 14.40 Fare
$ 4.50 Pullman

Ogden to
998 Mi
30 Ho
$ 35.82
$ 12.00

Ogden

Salt Lake City

San Francisco to Kansas City
2014 Miles
64 Hours
$ 63.60 Fare
$ 19.80 Pullman

818 Miles
28¼ Hours
$ 36.24 Fare
$ 9.00 Pullman

San Francisco

Population 4,125,000
Homes 1,022,000
Residential Consumers 944,453
Total Electric Consumers 1,102,783
Installed Generator Capacity
Hydro-Electric 967,500 KW
Steam 410,300 "

Population 485,300
Homes 101,500
Residential Consumers 86,100
Total Electric Consumers 106,200
Installed Generator Capacity
Hydro-Electric 150,000
Steam 16,950

San Joaquin R.

Kern R.

783 Miles
23½ Hours
$ 41.35 Fare
$ 9.00 Pullman

Colorado River

471 Miles
13½ Hours
$ 17.04 Fare
$ 3.00 Pullman

Population 417,600
Homes 93,000
Residential Consumers 17,900
Total Electric Consumers 22,250
Installed Generator Capacity
Hydro-Electric 28,200 KW.
Steam 1,950

Los Angeles to Chicago
2289 Miles
66 Hours
$ 80.14 Fare
$ 23.63 Pullman

Los Angeles

127 Miles
3½ Hours
$ 4.55 Fare
$ 3.00 Pullman

453 Miles
13¾ Hours
$ 20.76 Fare
$ 5.25 Pullman

Phoenix

San Diego

Gila River

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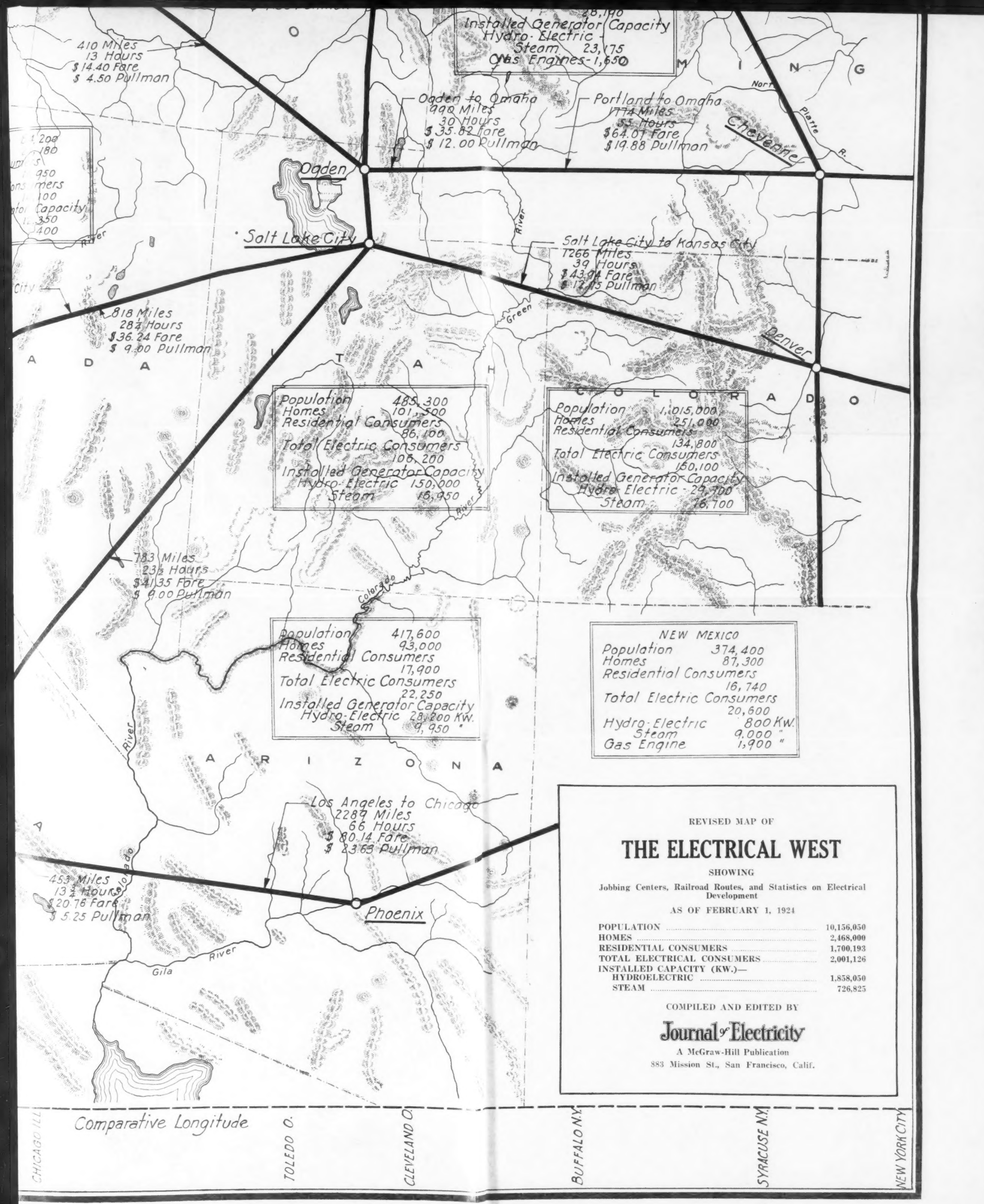
DES MOINES IA

CHICAGO ILL

Comparative Longitude

TOLEDO O.

CLEVELAND O.



Installed Generator Capacity
Hydro-Electric -
Steam 23,175
Gas Engines-1,650

Population 485,300
Homes 101,500
Residential Consumers 86,100
Total Electric Consumers 106,200
Installed Generator Capacity
Hydro-Electric 150,000
Steam 16,950

COLORADO

Population 1,015,000
Homes 251,000
Residential Consumers 134,800
Total Electric Consumers 150,100
Installed Generator Capacity
Hydro-Electric - 29,700
Steam 16,100

Population 417,600
Homes 93,000
Residential Consumers 17,900
Total Electric Consumers 22,250
Installed Generator Capacity
Hydro-Electric 28,200 KW.
Steam 9,950 "

NEW MEXICO

Population 374,400
Homes 87,300
Residential Consumers 16,740
Total Electric Consumers 20,600
Hydro-Electric 800 KW.
Steam 9,000 "
Gas Engine 1,900 "

REVISED MAP OF

THE ELECTRICAL WEST

SHOWING

Jobbing Centers, Railroad Routes, and Statistics on Electrical Development

AS OF FEBRUARY 1, 1924

POPULATION	10,156,050
HOMES	2,468,000
RESIDENTIAL CONSUMERS	1,700,193
TOTAL ELECTRICAL CONSUMERS	2,001,126
INSTALLED CAPACITY (KW.)—	
HYDROELECTRIC	1,858,050
STEAM	726,825

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ENGINEERING DEVELOPMENTS in 1923

By John Liston
General Electric Company

THROUGHOUT the electrical industry the year 1923 was characterized by a record volume of production in practically all classes of apparatus, exceeding in many cases the maxima of war-time output. The demand for electrical apparatus showed seasonal irregularities but manufacture proceeded almost uniformly at a high rate.

High-pressure production is not usually conducive to radical changes in design, and a considerable proportion of the improvements made were along conventional lines. There were, however, a number of distinctly new developments which represented advances in the art, some of which were fully commercialized while others were still being tested experimentally at the close of the year.

The recent tendency toward increased unit capacity continued in evidence. The 62,500-kv-a. turbine-generator, the first of the two 65,000-kv-a. waterwheel generators, and a synchronous converter of record size were completed while various types of transformers exceeded the record unit ratings of previous years.

In transportation, electric propulsion was for the first time applied to large cargo craft for canal service and improvements were made in auxiliary ship equipment. The more important railway developments occurred in foreign countries as in the preceding year and the high-voltage direct-current system was utilized to a large extent for main line steam railway electrification. In street railway service there was a further adoption of the economical light-weight double-truck car.

The use of automatic stations was extended to new industrial fields and initial foreign installations were made. Few radical changes occurred in either the design or construction, but the number installed and their unit capacity were greatly increased.

For radio service new tubes were developed of both higher and lower power than any previously produced and all sizes were improved in efficiency by the use of a new filament which gives high electron emission with low current consumption. Interesting and potentially important experiments were carried on with vacuum tubes for purposes other than communication, and carrier current telephone systems of increased range and power were used successfully on several power lines.

Investigations in high-potential phenomena were continued with the lightning generator, high-voltage direct-current testing sets and X-ray tubes of great power were developed, the photo-electric cell was practically applied in the operation of a commercial machine and a complete new line of electrically operated flow meters was standardized.

Higher efficiencies were achieved in the design of several types of industrial motors as compared with previous practice, and corresponding advances were made in the control apparatus to be used with them. The vast number of motor applications in modern industrial plants renders every detail improvement secured in the operation of individual motors of great potential economic value when considered in the aggregate.

Turbines

Developments during the year on large turbines consisted of refinement in mechanical details without radical changes in the construction. The outstanding features were the production of turbines for high steam conditions and the production of turbines in unprecedented volume.

Shipments for 1923, exclusive of turbines for mechanical drive and ship propulsion, had a total capacity of approximately 1,660,000 kw. This was an increase of 85 per cent over the average for the preceding five years and an increase of 32 per cent over the maximum war time production in 1917.

The first of the 35,000-kw. turbines designed for 550 pounds pressure and 750 deg. F. total steam temperature was completed and shipped while four of the same capacity and one 60,000-kw. compound unit to operate under similar steam conditions were under construction. It is confidently expected that the installation of these units will result in a substantial reduction in operating costs as compared with previous practice.

The solution of the problem of lower operating costs is being approached in two other ways. The first commercial equipment, which includes a mercury boiler and turbine exhausting into a condenser boiler which in turn generates steam for an existing steam turbine station was put in service in the fall of 1923. The results which have been obtained confirm experimental tests and there is every reason to believe that this development will be of great value in reconstructing many existing stations.

In addition to this there were under construction one 2600-kw. and one 4000-kw. turbine designed for a steam pressure of 1000 to 1200 pounds and to exhaust into

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headers supplying other turbines at from 250 to 350 pounds. These machines are an entirely new departure and involve special boiler equipment. The turbines, however, are simple in design and present no obstacles to the ultimate success of the system adopted.

Supercharger

A new turbine supercharger for airplanes was designed and built specifically for extreme altitude operation. It is rated to feed sea level atmospheric pressure to the engine at a height of 35,000 feet, or about twice the rating of the one used in the previous American altitude record flight.

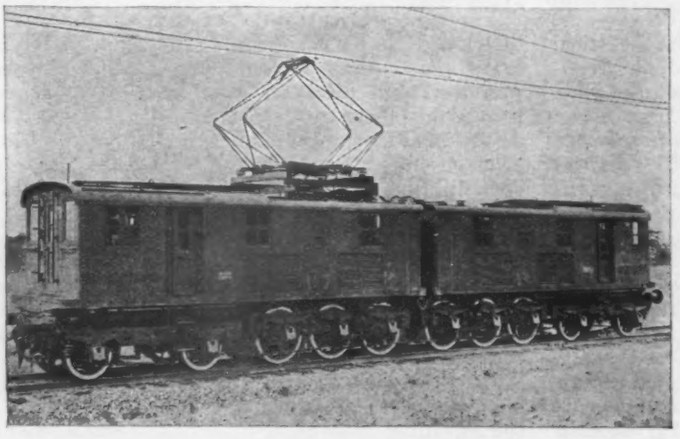
The supercharger consists of a turbine compressor mounted just back of the propeller blades of the plane on the front end of the Liberty motor and is operated from the red hot exhaust gases from the airplane motor, which ordinarily go to waste. It weighs about 140 pounds which might be considered a handicap in altitude flying but for the fact that at 35,000 feet its operation will increase the power of the Liberty motor by at least 280 horsepower or about two horsepower for each additional pound carried.

Electric Propulsion

Diesel-electric propelling equipments were adopted for two ships of a new type, built for refrigerating cargo service on the Great Lakes and New York State Canal System and for coastwise trade to the West Indies during the winter. The first of these ships, the *Twin Ports*, 258 ft. overall and 42 ft. beam with a full load draft of 13 ft. and a cargo capacity of 2600 tons, started commercial operation in September.

The electrical equipment comprises two 250-kw., 230-volt, 260-r.p.m. direct-current generators direct driven by two Diesel engines and two 250-h.p. motors direct connected to twin propeller shafts which give a speed of 13 miles per hour at full motor load.

Seven electrically propelled ferry-boats now in service after successful trials are showing excellent operating economies. One of these boats, the *Golden West*, running between San Francisco and Sausalito, which is rated as an 80 automobile boat and has Diesel-electric equipment, required 0.95 bbl. of fuel oil per running hour in comparison with a steam engine driven boat rated at 60 automobile capacity, on the same route and at the same speed, which consumed 3.35 bbl. per hour.



120-TON PASSENGER LOCOMOTIVE FOR PARIS-ORLEANS RAILWAY. THE HIGHEST-SPEED ELECTRIC LOCOMOTIVE, BUILT JOINTLY BY THE GENERAL ELECTRIC COMPANY AND THE AMERICAN LOCOMOTIVE COMPANY

At the close of the year there were G-E electric propelling equipments completed or under construction for 14 ships, making the aggregate rating of this class of machinery, from 1908 to date, more than 550,000 shaft h.p. for 45 ships.

Electric Railways

As in the preceding year the more important additions to main line electrification occurred in foreign countries and it is noteworthy that in a majority of cases the 3000-volt direct-current system was adopted.

Progress included the initial operation of 3000-volt equipment on the Spanish Northern Railway in Spain, six locomotives having been made ready for service during the latter part of the year. Two substations were also completed for supplying 3000 volts direct current for the operation of this line.

Ten 150-ton, 3000-volt locomotives for the Mexican Railway Company, Ltd., were completed and tested together with substation equipment which will be ready for operation by the time the first locomotives are placed in service.

In connection with the extensive electrification program being put through by the Japanese Imperial Government Railways, two locomotives weighing 66 tons each were placed in service.

Rapid progress was made in the manufacture of equipment for the Paris-Orleans Railways in France. The 120-ton, 1500-volt high-speed passenger locomotive was completed and tested and gave every indication of exceeding without difficulty all of the requirements for which it was designed. Speeds of more than 81 miles an hour, for which this locomotive was guaranteed, were made, and its riding qualities at high speeds surpass those of any electric locomotive ever built.

An event of considerable interest and importance to engineers connected with heavy steam road electrification was a series of tests of high-speed current collection during which a public demonstra-

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tion of a new type of overhead was made. The outstanding characteristics were the ability of this overhead to collect without sparking as high as 4000 to 5000 amperes on a single pantograph at speeds of from 50 to 60 miles per hour with a normal pressure of pantograph against the trolley wire of 30 to 35 pounds.

In order accurately and simultaneously to record the vertical and transverse thrust or impact of locomotive wheels on rails, an interesting device, called the Otheograph, was developed. Numerous tests under a variety of conditions have already been made with both steam and electric locomotives.

This instrument shows by graphic records the effect of each separate wheel of a locomotive or car on each of the two rails. These otheograph ties may be installed in place of the regular ties, either singly or several grouped together on curves or on tangent track.

The most effective aid to the rehabilitation of the electric railway system of the country was the remarkable progress in light weight car design. Some of these light weight installations such as the Cincinnati, Lawrenceburg & Aurora Street Railway, the Kentucky Traction & Terminal Company and others have been in service for a sufficient length of time to secure authentic operating data, which is most convincing. On the Cincinnati, Lawrenceburg & Aurora, for instance, savings over a period of 5½ years aggregated more than $220,000.

Automatic Railway Substations

The automatic railway substation continued to be popular with electric railways both in this country and abroad as was evidenced by a growing tendency to make electric railway systems completely automatic by installing automatic control for all substation units.

At the close of the year there were 70 railroad companies using G-E Automatic Substations with 225 equipments aggregating more than 170,000 kw. in capacity either in service or under construction. Thirteen railway companies each operate automatic substations with capacities of 4000 kw. or above.

Automatic Stations

There were many indications that the automatic station had become an accepted factor in the electrical industry as actual installations were more numerous than in preceding years, and many of the equipments built were of record capacity. Installations were also made in foreign countries for the first time.

The development of water power sources received more attention than ever before because of the high cost of fuel and labor and the need of additional sources of power to meet the needs of electrical expansion. Before the advent of the automatic station it was usually uneconomical to develop the water power sites of small capacity because of operating costs, but these small sites are now coming rapidly into prominence, and automatic hydro-electric stations are operating or being installed in nearly every state in the Union.

The largest single-unit automatic hydro-electric station in the world is being installed by the Adirondack Power & Light Corporation for their Sprite Creek Development near Little Falls, N. Y. It is rated 7500-kv-a., 6000-volt, 3-phase, 60-cycle, the largest previous equipment of this type being of 5000 kv-a. capacity.

The use of automatic substations in mining service was very decidedly increased and has fulfilled a real need in this particular field where trained operators are scarce, many comparatively small installations are required to meet operating conditions, and where the power output must be reliable.

The increase in automatic substation installations created a corresponding demand for centralized supervision in large power systems and two main classes of equipment were standardized for this service. The first class is called the selector type and is suitable for installations in which few operations are required per station and where the stations cover a wide area. The second class is called the distributor type and is best suited for power systems where a large number of operations per station are required and the stations are within a radius of twenty miles.

Switching Apparatus

The developments in switching apparatus consisted largely in the improvement of existing designs rather than in bringing out strictly new types of apparatus. Both horizontal and vertical isolated phase arrangements were worked out in detail for several important installations and the application of breakers to removable trucks was extended to include motor operated breakers with separating chambers.

An example of unusual design, rendered necessary by the high cost of real estate, consists of an equipment of 28,000-volt, triple-pole, oil circuit breakers which, including the control and operating mechanism, occupy a space just five feet square, but rise to a height of 58½ feet.

They are intended for the Hudson Avenue Generating Station of the Brooklyn Edison Company. The departure from the regular arrangement is found in the location and the control, rather than in the breaker units themselves, for these are of standard tank type construction. They are placed one above the other, one phase to a floor, with the operating mechanism on the fourth floor.

Relays

A new type of hinged armature relay was designed to function as a direct-current auxiliary relay and is of simple construction and very reliable in operation.

A new type of induction overload relay has as an outstanding feature a target which is "built in" the relay and indicates when

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the relay has functioned to trip the particular circuit which it controls. The contacts are definitely geared to the shaft. The holding coil of these relays, therefore, does double duty in that it holds the contacts closed after they have once been closed in any cycle of operation and also operates the target. This relay can also be provided with under-voltage protection.

Waterwheel Generators

The first of the two 65,000-kv-a. 12,000-volt, 25-cycle, 107-r.p.m. waterwheel generators for the Niagara Falls Power Company was completed and shipped in sections to the power site for assembly. It is the largest machine of its type, both in capacity and physical dimensions, so far constructed.

An unusual thrust bearing construction was provided for two 8200-kv-a., 150-r.p.m. and two 15,000-kv-a., 120-r.p.m., 6600-volt generators for the Phoenix Utility Company for installation in Alexander, Idaho and Fond du Lac, Minnesota. The upper bearing bracket which is ordinarily used to hold the suspension thrust bearing was omitted altogether in these machines and the bearing was located in the lower bracket between the rotor and the waterwheel, the lower bracket being strengthened for the exceptional service required of it. This arrangement permits ready access to the stator coils for inspection or replacement as the rotors of the smaller machines or the stators of the larger ones can be lifted with an overhead crane by the removal of a few bolts.

STATOR CASTINGS OF 65,000-KV-A. WATERWHEEL-DRIVEN GENERATOR ARRANGED ON TURNTABLE FOR MACHINE WORK

Frequency Converters

A frequency converter of exceptional capacity and unusual characteristics was constructed for tying together the 25 and 60-cycle systems of the United Electric Light & Power and the New York Edison Companies.

The induction type unit will supply 150,000 kv-a. to the 60-cycle system with a short circuit on the 60-cycle bus and with 25-cycle bus voltage maintained. In the reverse direction, it will supply 191,000-kv-a. to the 25-cycle system with 60-cycle bus voltage maintained. The induction unit will be excited from the 25-cycle synchronous generator and the set is designed for unity power-factor, input and output in either direction at full load.

The kilowatt capacity of the set is nearly three times that of the largest frequency converter previously built, and marks a new epoch in the construction of horizontal-shaft alternating-current machines.

Industrial Motors

The single-phase motor is an important factor in many industrial applications but early designs had certain electrical and mechanical characteristics which tended to limit the field of its practical utility. A new type single-phase motor which operates on the squirrel cage induction principle was developed which eliminates entirely the short-circuiting switches heretofore considered essential and permits the simplest possible construction.

A complete new line of 40-degree continuous duty riveted frame polyphase motors in sizes up to 15 h.p. was designed with numerous improved electrical and mechanical characteristics as compared with previous construction for this class of motor.

During the year considerable work was done towards standardizing the bores of small high speed motors used generally by the woodworking trade. Through the efforts of several of the electrical companies, most of the tool manufacturers are now using a definite bore for these shaftless motors. Before this standardization, there were a great many different bore dimensions for the same frame, which was decidedly objectionable from a manufacturing standpoint.

Industrial Motor Control

A number of improvements were made in the apparatus designed for the control of industrial motors, which, despite the relatively small size of the individual controller, are of great economic value due to the vast extent of the field of present day industrial motor application.

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Among the more important of the new designs is a starting switch for three-phase motors, sizes up to 7½ h.p., 440 and 550 volts, which is of the positive quick-make and quick-break tumbler type, totally enclosed with the operating handle on the front and a locking plate on the side so that it may be locked to prevent either the opening of the box, the closing of the switch, or both.

An ingenious design of a magnetic switch provided with a thermal overload relay was developed to meet the demand for starters of compact construction and for mounting in the frames of machines. It is suitable for motors up to 10 h.p., 550 volts, 25 to 120 cycles, and the units can easily be arranged on panels so as to insure complete control, at any point desired, of machines driven by two or more motors of either the same or different ratings.

Motor Applications

To meet the requirements of the Russian Government in regard to electrical equipment for oil well drilling, two totally enclosed induction motors were developed, rated 75 h.p. and 50 h.p., 750 r.p.m., with a temperature rise of 45 deg. C. These motors are unique in that they are the largest totally enclosed, self-ventilated motors yet manufactured, previous designs in these sizes having employed water as a cooling agent.

The H. C. Frick Coke Company is installing a belt conveyor approximately five miles long for transporting coal from the mine workings to the shipping station. It consists of twenty sections, each driven by an induction motor. The motors vary in size from 50 to 175 h.p. and are all of the wound rotor type. Solenoid brakes are provided for stopping and holding the conveyor belts when power is cut off from the motors and the control is so arranged that the motors start in sequence beginning at the delivery end. As each motor reaches full speed, it energizes the starting circuit of the next succeeding motor. If any motor stops, it automatically stops all the motors preceding it in the conveyor system but allows those following it to run and clear the belts of coal.

Electrical equipment was provided in 1923 for two direct-current coal tower hoists for the new Hudson Avenue Station of the Brooklyn Edison Company to give a hoisting rope speed of 1460 ft. per min. and a lowering rope speed of 1680 ft. per min. on the 200-ft. lift and to give a guaranteed delivery of 250 tons per hour, using a 2.5 ton grab. The hoist motor is rated 625 h.p., is direct connected to the hoisting drums and takes its power from a 575-kw. motor-generator set mounted in the tower and driven by a 700-h.p., 2300-volt, 3-phase, 60-cycle induction motor.

A noteworthy installation of motor drive and control was made at the plant of the *Public Ledger*, Philadelphia, Pa., for operating a battery of new printing presses. This equipment in size, arrangement and construction details is unusual and represents a distinct advance over previous practice. An improved form of control is employed, embodying the new bent frame contactors and relays which were designed especially for this service together with a simplified and improved form of pilot motor operating mechanism.

Steel Mills

There was added to the existing main roll drives, 300 h.p. and over, 44,100 h.p. (normal continuous rating), bringing the total to 612,110 h.p. The tendency towards the use of high-speed motors with reduction gears, which has been quite marked for the last few years, continued to gain headway and over 90 per cent of the new motors were for geared drive.

One of the most important developments of the year was the building of alternating-current brush-shifting motors with shunt characteristics. Two machines of this type, which gives adjustable speed without auxiliary apparatus, were under construction for the Halcomb Steel Company, Syracuse, New York, for driving merchant mills, and are rated 600/400/200 h.p., 321/214/107 r.p.m., 440 volt, 25 cycle and 500/385/250 h.p., 130/100/65 r.p.m. for the same power supply. There has long existed a need for an adjustable speed alternating-current motor that was simple and did not require a large amount of auxiliary equipment, and whose speed would be practically independent of its load. This machine is the first practical piece of apparatus to meet these requirements.

Electric Welding

The most important achievement in arc welding was a radical improvement in the construction of the electrode. As the result of exhaustive research and experiment, a mechanical construction was developed which makes it easy to combine the desired welding flux within the body of the electrode, thus securing all of the advantages which could be obtained with an externally coated electrode, without its disadvantages.

The results of this research work were made available commercially by the development of new methods of manufacture, the ingredients of the fluxes being fused together in an electric furnace, finely ground and mixed with suitable solvents. Special machines were developed for applying the sheath to the core while feeding in the exact amount of flux required to fill the intervening space. These machines have attachments for straightening and cutting the finished electrodes, where these are to be used for hand welding, while the finished electrode material for use with automatic welding machines is wound on reels in continuous lengths.

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Induction Furnaces

The new type of induction furnace, which utilizes the force of electro-magnetic repulsion existing between transformer primary and secondary windings, to cause a circulation of molten metal between the heating circuit and the melting pot, was operated only experimentally during 1922.

Fifteen 75-kw., 1200-lb. induction furnaces were placed in commercial operation for melting non-ferrous metals in 1923 and a number of additional units were under construction.

A notable accomplishment of the repulsion-induction furnace was the successful melting of pure copper on a commercial basis.

The largest horizontal ring type induction furnace in the United States was built for installation at the Allegheny Steel Company. It has a maximum capacity of six tons and in normal service will melt three tons every three hours.

Industrial Heating

The electric furnace was for the first time successfully used for bright annealing of copper wire.

Another special furnace was developed for annealing steel punchings used for field and armature laminations. It is built 6 ft. above the floor on a structural steel support, and the laminations are placed on a car which is rolled under the furnace and raised into the heating chamber on a hydraulic platform. Around the edge of the car is a sand seal which makes the furnace air tight when the car is in place.

Transformers

The recent tendency to concentrate the transformation of electrical energy in units of increasing capacity was evidenced by the construction of a large number of transformers of record size. A notable event of the year was the placing in service of the 220,000-volt units at Power House No. 8 of the Southern California Edison Company's system from which approximately 20,000 kw. was initially transmitted to Eagle Rock substation near Los Angeles.

There were under construction two self-cooled, three-phase, 60-cycle units which will transform 15,000-kv-a. as auto-transformers from 72,000 volts Y to 132,000 volts Y with solidly grounded neutral. Both of these windings will have taps. They will also transform 15,000 kv-a. from either

METERING OUTFIT (REMOVED FROM TANK) FOR 90,000-VOLT SYSTEM OF PARIS-ORLEANS RAILWAY

of the high-voltage windings to 12,470 volts and simultaneous operation on all three windings is possible. These transformers are larger in physical dimensions and in kv-a. rating than any self-cooled transformers heretofore built, the largest previous rating being 12,000 kv-a.

Seven 60-cycle 10,417-kv-a. single-phase, self-cooled auto-transformers of unusual construction were built for the Brooklyn Edison Company. They step up the generator voltage from 13,800 volts to 27,600 volts and have a normal rating of 10,417 kv.-a, but since they are auto-transformers of a one to two ratio, each will transform a total of 20,834 kv-a. so that the total output of a bank of three units will be 62,502 kv-a. This is probably the largest amount of energy transformed by a single bank of self-cooled transformers.

The maximum capacity for single-phase, water-cooled transformers was increased by the construction of ten units, rated 22,000 kv-a., 39,500/68,500/2300 volts, 25 cycles for the Niagara Falls Power Co.

A three-phase air-blast transformer exceeding all previous units in both capacity and physical dimensions, was built for the New York Edison Company. It is rated 17,100 kv-a., 11,800/2950 volts, 25 cycles.

There was further demonstration of the value of concentric circular windings for extra high-voltage transformation. The marked advantages of this type over the oil interleaved (sandwich) type had been brought out in studies of impressed high-voltage transients on commercial transformers, this work being carried on in the high-voltage laboratory of the Pittsfield Works. The unique equipment of this laboratory has placed high-voltage transformer design on a scientific basis heretofore unattainable and has made possible the absolute checking of calculated phenomena.

An unusual arrangement of instrument transformers was provided for metering energy on the high-potential side of substations on the Paris-Orleans Railway. Four 60,000-volt transformers each have three current and two potential transformers while two 90,000-volt units have three each of current and potential transformers mounted in a single tank with three high-voltage leads.

The 90,000-volt arrangement is unique in that the three current transformers are located inside the porcelain bushings, whose headers also serve as oil conservators.

The average unit size of self-cooled transformers continued to increase but due to specific conditions the average for all types

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was somewhat reduced as compared with 1922. The table shows the average rating for the past five years.

Year	Self-Cooled	Water-Cooled	All Types
1919	1175	4325	2150
1920	1325	3175	2175
1921	1575	4150	2750
1922	1700	6000	3750
1923	2350	5125	3220

At the close of the year there had been completed or were under construction a total of more than 180 units of 10,000 kv-a. or above.

Induction Voltage Regulators

A new design single-phase induction voltage regulator was developed, which embodies a number of improvements as compared with previous types. In addition to improving the voltage regulation by a more rapid correction of voltage changes, it utilizes a tank which is highly resistant to rupture as a result of explosions, and a rigid internal mechanical structure to minimize noise during operation. An improved method of bracing the coils prevents insulation troubles due to line short circuits.

Lightning Generator

The lightning generator installed in the High Voltage Laboratory of the Pittsfield Works will produce voltages of approximately 2,000,000 above ground. This is perhaps higher than lightning voltages that are usually produced on transmission lines. These voltages are of a known wave shape and duration. The wave front is under control and may be made so steep that the voltage starting at line voltage may be made to increase at the rate of 50 million million volts per second. The rate that energy is dissipated in the arc is generally of the order of millions of horse power. The duration of such discharges is conveniently measured in microseconds.

Lightning Arresters

A new type of oxide film arrester, known as the pellet arrester, was developed commercially. In this arrester, the lead peroxide, which is the active element of the oxide film type of arrester, is utilized in the form of small pellets about one-eighth of an inch in diameter, which are covered with litharge. This litharge coating acts like the varnish film on the plate type of oxide film arrester and thus each pellet becomes a small oxide film cell. The pellets are put into a porcelain container and are connected to the line through a gap.

Electrically Operated Flow Meters

A type of electrically operated flow meter with many new characteristics was developed for accurately measuring the total flow of steam, water, air, gas, oil, etc., through pipes and so furnishing information of great value in the economical management of any manufacturing industry or central station. It does not supersede the G-E mechanically operated flow meter, but is simply an addition to existing types.

Due to the electrical principle of operation the indicating, curve drawing and integrating instruments can be located at any distance away from the pipe where the flow is being metered and the instruments can be either separated, grouped or duplicated.

X-Ray Tubes

A new tube having fifteen times the X-Ray energy of the average tube now in commercial use, was produced for therapeutic work.

It is rated 250,000 volts, 50 milli-amperes, and is provided with cooling coils which carry the circulating water direct to the back surface of the anode. It is the first high-voltage tube equipped with a cooling system of this type.

The new tube has not yet been developed commercially but has been used experimentally for several months. The previous maximum size, rated 200,000 volts. 8 milli-amperes, is now in commercial production.

Photo-Electric Cell

An extremely sensitive photo-electric cell was developed, consisting of a small bulb into which two electrodes are sealed. The inside walls of the bulb are coated with silver with the exception of a very small area which is kept clear for the passage of light.

The action of light focused on the cell through the clear spot causes increasing electron discharge from cathode to anode with potentials as low as 50 volts. Due to the sensitivity of the cell very slight variations of light cause the current to change very rapidly. By using vacuum tube amplifiers the current from the cell can be increased to any value desired.

This photo-electric cell has already been applied commercially in the mechanical sorting of cigars according to color. The process is as follows: The cigars are carried on a mechanical conveyor and at a certain point a beam of light strikes a cigar. The light reflected from the cigar falls on the eye of a photo-electric cell and since the cell current changes as the light intensity varies, the current from the cell, through an amplifier, causes the mechanical gates to operate through which the cigars fall into boxes graded according to color. By means of this device it is possible to sort cigars much faster and more accurately than by hand or by any other method heretofore devised.

Conductor Cable

As the result of exhaustive research work, the manufacture of 66,000-volt single-conductor cable was for the first time placed on a commercial basis.

The cable produced was for the Cleveland Electric Illuminating Company and can transmit upwards of 33,000 kw. at 66,000 volts. It is slightly over three

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inches in diameter and requires 250,000 volts to puncture.

The previous maximum potential for conductor cable in the United States was 44,000 volts, cable of this rating being utilized for the underground circuits of the New York Edison Company.

High Voltage Direct Current Cable Testing Sets

The purpose of direct current testing sets is to permit power companies to make satisfactory periodic test of underground cables, to determine the condition of insulation between conductor and ground and to locate cable faults and measurements of insulation resistance. Three types of equipment were developed and standardized for this service.

For station use, to be considered as a stationary outfit, a four-kenotron 200,000-volt set was designed, each kenotron being capable of rectifying 250 amperes direct current.

For cable testing this set is used in the following manner. During one half cycle the current flows through two kenotrons in series and charges one conductor, during the other one half cycle current flows through the other two kenotrons and charges the other conductor with the reversed polarity, so that the voltage between the conductors will be twice the crest value of the transformer voltage. The voltage across the two kenotrons in series on the reverse wave will be the transformer voltage plus the voltage from the conductor to ground, which will be a maximum of 200,000 volts.

The direct-current voltage is measured by special meters which measure the crest value of the voltage wave obtained from the voltmeter coil. Two meters are used, each meter reading the voltage from conductor to ground and the voltage between conductors is the sum of the two readings of the voltmeters. The current supplied to the cable is measured by two ammeters connected between the ground and the transformer winding. In series with each meter is a Tungar rectifier which divides the current so that one half wave flows through one meter and the other half wave flows through the other meter. In this way the current which is supplied to each conductor is measured separately.

A smaller set rated at 100,000 volts and 100 M.A. is semi-portable and can be moved around a station or moved from one station to another by truck. It functions in essentially the same manner as the 200,000-volt set, except that it is limited to lower voltages and current and only two kenotrons are used.

WATER-COOLED TUBE UNIT FOR 20-KW. TRANSMITTER

For portable testing a 30,000-volt set, using the 100-M.A. kenotron, was designed primarily for measuring insulation resistance and not for high-potential testing. By means of this type of equipment it is possible to locate cable faults which can later be given further tests by means of one of the higher power equipments.

Radio

The improvements in vacuum tubes for radio purposes were mostly in the direction of increased efficiency of operation and a general betterment of electrical characteristics.

It is also interesting to note that during the year there was started in regular production a new tube of the highest power so far standardized, and also the smallest tube requiring the least power expenditure in the filament that has so far been made available for radio receiving sets.

The smallest standard receiving tube, UV-199, operates with an expenditure of only 0.18 watt for the filament, which is of a new type and insures high electron emission, silent operation and long life.

The development of the new filament made possible the remodeling of the Radiotron UV-201, the previous standard receiving tube, so that it only required one-quarter the former amount of filament power. At the same time the characteristics of the tube were changed so that it became a better detector and amplifier.

A loud speaker was developed for use as an addition to sets not already equipped with one. It is very sensitive and reproduces signals with clear quality and a single adjustment is provided for the diaphragm, which gives good operating efficiency over a considerable range of signal intensities.

Early in the year, the requirements for receivers took on a new aspect. Portable and self-contained receivers had become possible due to the new tube developments, and these suddenly were widely demanded. The receiver designed to meet this need utilizes a single-circuit regenerative system with a detector and an audio-amplifier tube, functioning well over the broadcast range. The method of control is exceptionally simple. The telephones and plug are carried in the front

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cover, while the batteries are in the rear. Having a complete weight of but 18 lb., the set is made easily portable by the addition of a leather carrying handle.

Developments in the line of commercial receivers included the standardization of those used in the trans-Atlantic and trans-Pacific stations of the Radio Corporation of America.

Carrier Current

The carrier current system of telephony, which effects communication by means of high-frequency currents superimposed on the power conductors of transmission lines, was applied over greater distances than heretofore by the production of a 250-watt transmitter, and receiving equipment. The rating of the previous outfit was 50 watts and its maximum range in an actual installation was 88 miles.

With the larger equipment service is now being maintained over distances up to 116 miles, with apparatus under construction for communication over 138 miles. The progress already made in this new method of telephoning is indicated by the fact that it has already been adopted for 70 transmission lines with an aggregate length of over 2000 miles.

Battery Chargers

A new constant potential motor-generator 7½/15-volt battery charging outfit was produced, which includes a special regulator to maintain the voltage constant at the busbars, regardless of the number of batteries being charged.

This permits the use of shunt windings only on the generator thereby obviating any possibility of the reversal of polarity during power failure. The voltage to be held by the regulator is adjustable by means of a thumb screw.

The "Magnar", which is a mechanical rectifier of the vibrating type, used principally for charging storage batteries in railway signal service, was only experimentally installed in 1922, but during 1923, as a result of their demonstrated reliability, several thousand were utilized on more than 75 railway systems with entire success. Among the larger railroads, 1000 were supplied to the Illinois Central and 600 to the New York Central.

For charging the batteries of electric vehicles there was produced and standardized a new dead front type of panel board, made up of removable steel sections.

Lighting

The volume of sales of incandescent lamps serves as a reasonably accurate measure of the expansion of the lighting business. It is estimated that about 225,000,000 large tungsten filament lamps were sold in the United States during the year 1923. This is nearly 11 per cent increase over 1922, and exceeds any previous year. The figures do not include the sale of miniature lamps, which are used in large numbers for automobiles, flashlights, etc. The sales of carbon lamps are also excluded, since they have shrunk to an insignificant number.

The construction of the more important types and sizes of tungsten lamps was changed to eliminate the tip on the bulb, thereby reducing liability to breakage and improving the appearance of the lamps. The change necessitated extensive changes in certain processes of lamp manufacture, requiring new machinery and apparatus.

A new method of making the popular sizes of lamps was adopted by some of the lamp manufacturers. Formerly, individual machines and departments performed particular processes, the lamps or parts being transported from one location to another, between steps of manufacture. This required considerable floor space for storing and handling. With the new method of manufacture, the various parts of a lamp are made and assembled on a single "unit" machine.

In the sign lamp, the shape of the filament was changed to a coil ring form which makes the filament mechanically stronger and increases the end-on candle-power of the lamps. As used in signs, the spots of light appear larger and, when properly spaced, the appearance is more nearly a continuous line of light than that secured with previous types.

The healthy growth of the miniature lamp business during the year is indicated by the increase in sales to about 110,000,000 as compared with 85,000,000 for 1922, that is, an increase of about 30 per cent. Of the lamps sold in 1923, about 20 per cent were for flashlight service, 12½ per cent for Christmas tree decoration, and 65 per cent for automobile service, the remaining 2½ per cent being of miscellaneous types.

Street Lighting

The year was notable in many respects in street lighting history. Traffic has continued to multiply so rapidly that the present systems of lighting on thoroughfares in most cases are inadequate and in an effort to correct this condition and relieve night congestion of traffic, many cities have realized the necessity of revamping their entire street lighting systems.

In all of these cities there was a noticeable trend toward high intensity lighting in the business districts. The effect of such systems on the character of modern street lighting can be readily appreciated by the increase in the light intensity on some of the streets recently equipped as indicated by the following Table:

INCREASES IN INTENSITY OF ILLUMINATION AS COMPARED WITH SUPERSEDED SYSTEMS

Market Street, Lynn	18 times
Broadway, Saratoga	15 times
Market Street, San Francisco	15 times
Triangle District, San Francisco	12 times
South State Street, Chicago	11 times
Main Street, State Street and Broadway, Salt Lake City	8 times
Broadway, Los Angeles	6 times

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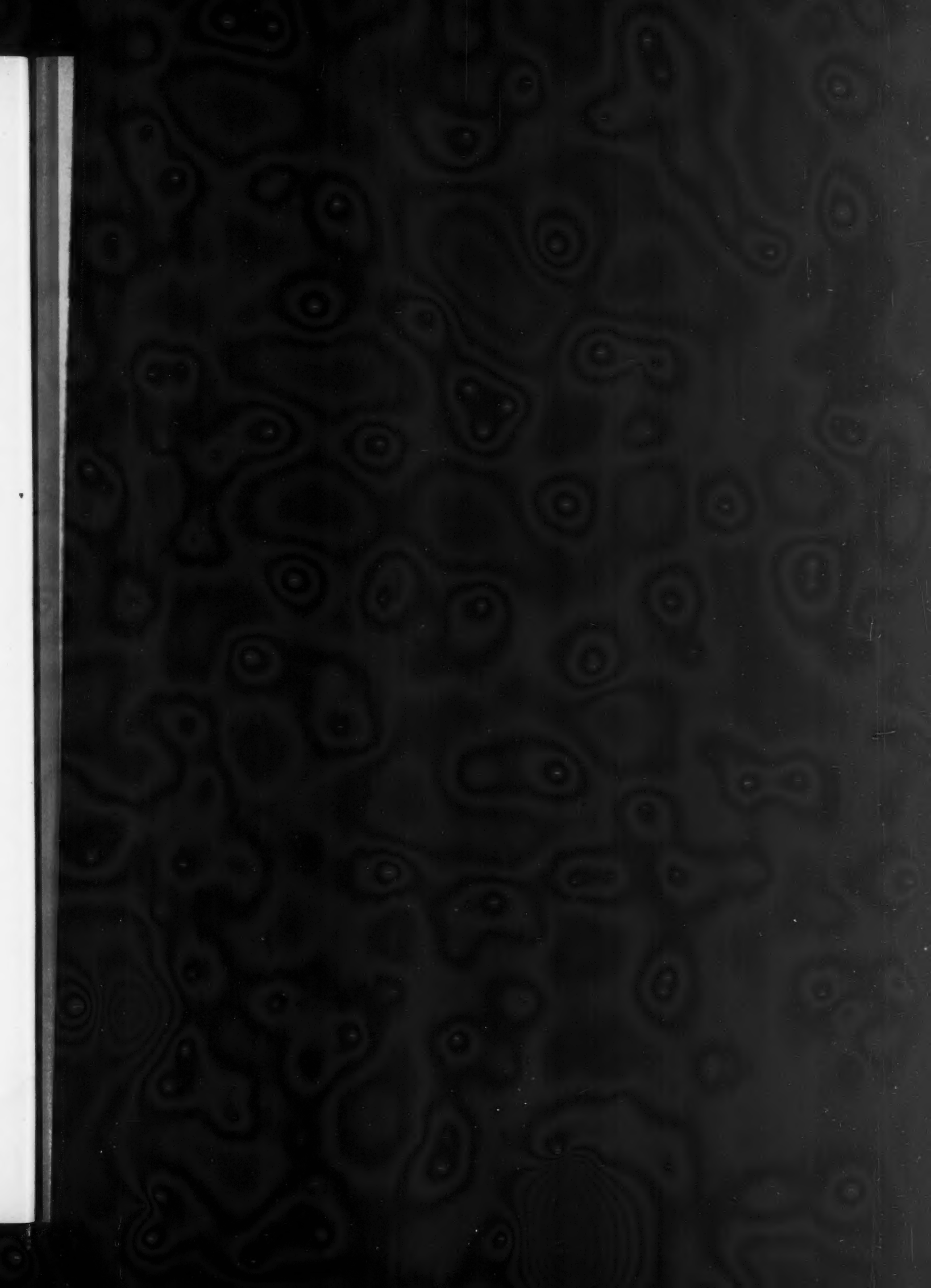
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